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of

Nurse Anesthetists

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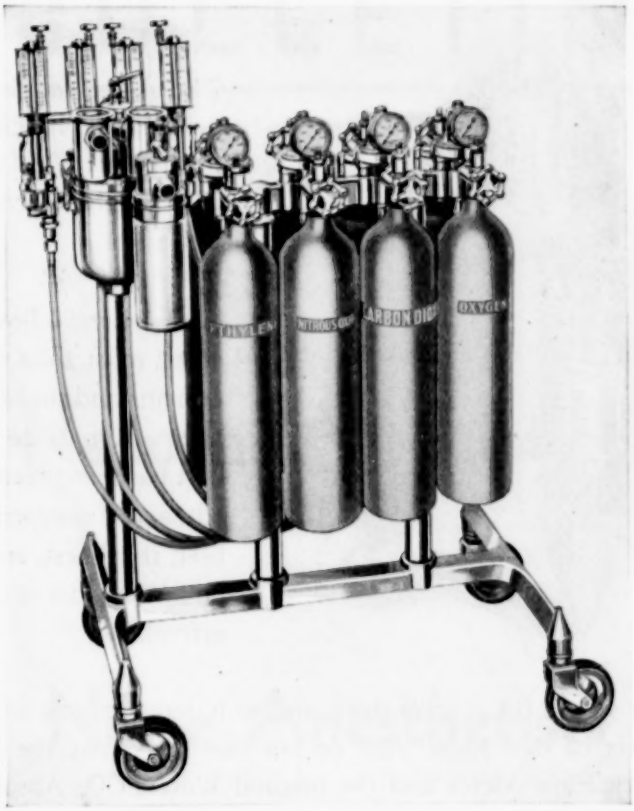

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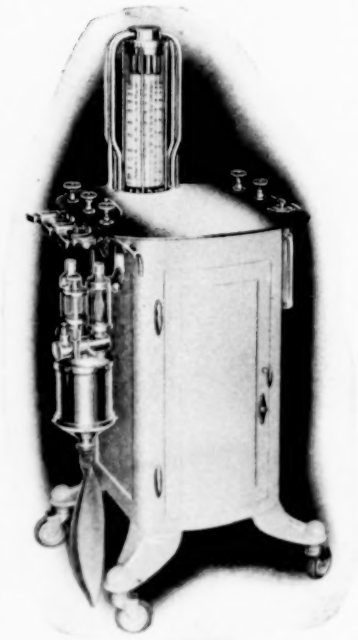

The pioneer first in the new field has his choice of the entire field and, accordingly, selects the best spot.

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ST. LOUIS AS THE CONVENTION CITY

The city of St. Louis presents many features of especial interest ranging from the quaint historic quarter which contains the Old Court House with its still intact stone auction block from which slaves were auctioned in the antebellum days, to its modern lovely residential districts and industrial developments containing such plants as the Mallinckrodt Chemical Works, where are made today's anesthetic ether, chloroform and other products used by our profession.

For visitors who are interested in horticulture, the city exhibits permanently one of the largest botanical gardens in the world —the Shaw Gardens of some seventy-five acres, whose floral displays have become known throughout the world, and which in fact rank second only to the famous Kew Gardens of England.

An extensive system of public parks provides beauty of landscape, the principal one (Forest Park) containing within its 1400 acres the Jefferson Memorial and its collection of Lindbergh Trophies, comprising the gifts sent from all nations to Colonel Lindbergh after his memorable flight to Paris. Within this same park is a Zoological Garden of some seventy-five acres, housing an impressive collection of animals, reptiles, birds, et cetera, obtained from all parts of the world.

Two great Universities afford an educational background to the city, which is supplemented by seven Colleges and a group of preparatory schools which have within the past few years influenced the entrance requirements of even the great Eastern universities.

Climatically and scenically, October is one of the loveliest months of the year in St. Louis, and members attending the convention may feel assured of an interesting and enjoyable visit.

THE THIRD ANNUAL MEETING OF THE NATIONAL ASSOCIATION OF NURSE ANESTHETISTS WILL BE HELD IN CONJUNCTION WITH THE AMERICAN HOSPITAL ASSOCIATION, OCTOBER 1st, 2nd and 3rd, 1935, IN ST. LOUIS, MO.

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AN EVALUATION OF ANESTHETIC DRUGS AND METHODS

AGATHA C. HODGINS

Honorary President, National Association of Nurse Anesthetists

A consideration of the historical background of anesthesia in its contributing aspect to the subject of this paper would lead us into too many fascinating by-paths and occupy more time than could be reasonably allotted. We must therefore only touch lightly upon such links as connect the past with the present.

The real beginning of anesthesia was toward the close of the 18th century, when the brilliant discovery of hydrogen in 1766 by Cavendish, nitrogen in 1772 by Rutherford and oxygen and nitrous-oxide by Priestley in 1774, paved the way for inhalation anesthesia; following events culminating in the successful use of ether vapor as an anesthetic by Dr. Crawford Long of Jefferson County, Georgia, in 1842. Later, in 1844, Horace Wells, of Hartford, Connecticut, attempted, but unsuccessfully, the use of nitrous-oxide gas for the same purpose. Chloroform, discovered by Flouren in 1847, was used for anesthetic purposes by Simpson of Liverpool, England, in that same year. Flouren also brought attention to the anesthetic properties of ethyl chloride, but in spite of many attempts, the drug has never taken the place of a major anesthetic, its use being limited as a preliminary to ether — and for short anesthesia in young children. It is also used as an anesthetizing spray.

Ether and chloroform, once accepted, became widely used and for many years held the field. Today ether is still an important anesthetic and perhaps the most useful, due to the simplicity of administration and ability to produce anesthesia without supplementary aid. Ether is also invaluable as a supplement to gas anesthesia; greatly increasing its usefulness and widening its application.

As a result of recent research (by Goldschmidt and co-workers, University of Pennsylvania) divinyl ether has been added to our list of inhalation anesthetics. While it is premature to predict, with any degree of certainty, the place it will occupy in the future, clinical experiences, already published, give promise of value. Until further work verifies this favorable report, it should be used with caution.

Chloroform, for many years a prime favorite, is being widely discarded, doubtless due to the fact of its now known uncertain and damaging action. This loss of place has not occurred without great effort on the part of its adherents to keep the drug in active use. Even today, an heroic attempt is being made to persuade us of its safety, if vaporized with oxygen and low percentages of carbon dioxide. Some authorities emphasize the usefulness of chloroform in operations upon the upper respiratory tract, necessitating the use of the actual cautery or diathermy.

Both of these anesthetics have run the gamut of praise and blame and as a result of early trial and error, and later intelligent research, not only have methods of administration greatly improved, but more precise

knowledge of the dangers attendant on their use are known and safeguarding measures established.

One of the first of these protecting methods was the use of premedication. The idea originally came from Claude Bernard who reported experiments on dogs, using morphine as a preliminary drug. Following this example Alexander Crombil, a surgeon of Calcutta Medical Hospital, advocated morphine as a preliminary to chloroform in humans. The history of pre-anesthetic hypnotics and narcotics is, in itself, of engrossing interest. Suffice to state here that from this simple beginning, we have today a fairly wide selection of drugs that can be safely used for preliminary medication, the definite object of their use being to cut down the psychic disturbances of the patient and lessen the amount of the inhalation anesthetic.

Further study has evolved the use of sequence and combination methods, and still further elaboration includes the use of synergists and basal anesthetics. With these more recent developments this paper is particularly concerned.

Before this comparatively recent work can be logically considered we must deal briefly indeed, with the function of pure oxygen in anesthesia. Early work in oxygen, originating with Priestley, was followed up by Bert, DeMarquay, Richet, Haldane, MacLeod, and many others. Dr. Andrews of Chicago is however the one credited with first applying its use to anesthesia. In 1868 he published the fact that by combining pure oxygen with nitrous oxide, a non-asphyxial form of anesthesia was produced. This discovery established nitrous oxide as a specific anesthetic and emphasized the necessity of preventing its asphyxial effects, by the exclusion of atmospheric air and combining with it controlling percentages of pure oxygen. Neudorfer of Vienna, in 1886, advocated the use of oxygen with chloroform and Kreutzman of San Francisco wrote of the use of a simple apparatus for giving chloroform-oxygen anesthesia. Today it is recognized that oxygen, essential with gases, also increases the safety of any anesthetic. Gwathmey of New York deserves great credit for research work done on this subject.

Recent and increasingly significant research on oxygen need during anesthesia, is particularly valuable in its application to the handicapped patient. It is now an accepted fact that in patients suffering from cardio-renal diseases, septic toxemias, reduced hemoglobin, respiratory affections, disturbed metabolic conditions such as diabetes and hyper-thyroidism (Basedow's disease) increasing oxygen over 20 per cent is necessary to maintain safety during anesthesia and to protect against damaging post-operative acidosis. Patients in shock during anesthesia require not only the diminution of the anesthetic but an increase of oxygen. Cannon states that in first degree shock the oxygen need is from 20 per cent to 30 per cent, second degree shock 30 per cent to 40 per cent and third degree shock 40 per cent and upwards. Practical application of Cannon's work was made during the Great War to shocked and exsanguined soldiers. The role of oxygen in preventing dangerous anoxemia is therefore of prime importance. The beneficial effects of oxygen therapy in combating endangering air limitation and cardiac strain, occurring in

pneumonias and other cardiac and respiratory conditions, needs no comment. We are today steadily increasing the scope of oxygen therapy and modern means for its efficient control and application are evidenced by the increasing use of oxygen tents and better control of intake by inhalation methods.

An understanding of the function of carbon dioxide in anesthesia, secured either by rebreathing or adding a known percentage of the gas to the anesthetic mixture, has given us a surprising control of respiration during operation; the result of which is not only evidenced by a smoother anesthesia but contributes greatly to the safety of the patient both during operation and post-anesthetic. Briefly, carbon dioxide is used in induction stage to increase the volume of breathing, thus facilitating the movement of the gases and hastening sleep; in the maintenance stage to correct respiratory depression from any cause. It is also of great value in stimulating respirations when the blood pressure is falling, the direct effect of carbon dioxide on the vascular tone being contributing cause to the rise of blood pressure and the increased volume of breathing produced allows for a better diffusion of necessary oxygen. It is utilized toward the end of the operation for the double purpose of ridding the body of possibly damaging amounts of the anesthetic and by complete aeration of the lungs provides prophylaxis against post-operative complications such as atelectasis (partial or massive collapse of the lung). This same procedure carried out at intervals post-anesthetic where respiratory disturbances exist, protects against possible later thrombotic or embolic accidents. Carbon dioxide and oxygen mixtures are used successfully to combat undue depression following the use of avertin, the barbiturates, or damaging effects of ether or chloroform. The percentage used for this work is, in adults, 10 per cent carbon dioxide and 90 per cent oxygen, with children 95 per cent oxygen and 5 per cent carbon dioxide.

The increasing use of carbon dioxide-oxygen in the latter (95 per cent oxygen plus 5 per cent carbon dioxide) mixture for resuscitation from poisonous gases, alcoholic depression and morphine poisoning, is now well established. The mixture of carbon dioxide 30 per cent and oxygen 70 per cent has been successfully used for hiccoughs, inhalations of short duration — 2 to 6 breaths — repeating at intervals as the paroxysms indicate. The well-known use of low percentage of carbon dioxide, 2—5 per cent, for resuscitation of the new-born need not be enlarged upon here.

Nitrous oxide is not a recent development but its adaptation as a supplementary aid in the modern use of synergists and basal anesthetics emphasizes its importance as perhaps the least damaging in its anesthetic action and certainly the safest in regard to explosibility. Nitrous oxide, a light anesthetic, requires supplementary aid of either increased premedication or combination with ether vapor. As an analgesic used with local anesthetic, in the opinion of many, it affords the greatest protection to the handicapped patient. It was on this belief and premise that Dr. Crile's theory (anoci-association) was elaborated.

The acceptance and popularity of nitrous oxide-oxygen resulted in the perfecting of gas apparatus, including the auxiliary appliances necessary for intratracheal and intrapharyngeal methods, and later for use of

carbon dioxide and ethylene gases, in sequence or combination. With accumulation of experience and knowledge we have now a flexible control of this anesthetic and continuing use enhances its value. This perfected control furnished the necessary equipment, and with slight modifications the technique of administration, for the use of the newer gas, ethylene.

Ethylene (C_2H_4) — an anesthetic of the hydrocarbon olefine group, a lipoid solvent with action analogous to ether; lends itself to the same wide application as nitrous oxide, and, like it, must be administered with controlled percentages of oxygen. Ethylene occupies middle ground between nitrous oxide and ether, being more potent than the former and less potent and irritating than the latter. To Luckhard and Carter of The University of Chicago, the credit is due for enlarging upon early and meager experimental work done on this gas dating from 1849. In 1922, through their efforts, a successful demonstration of ethylene anesthesia was given at the Presbyterian Hospital, Chicago, Dr. Herb, anesthetist. Since this date ethylene has become well and favorably known. Ethylene mixed with certain percentages of oxygen is a highly explosive gas and it was an unfortunate thing that during its early use distressing explosions occurred, due to inadequate knowledge of its explosive range and preventive measures, necessary to avoid accidents. The handicap thus created has been difficult to overcome and it seems only fair to state that authoritative, present opinion is that "the relative explosive hazards of ethylene and ether, when mixed with air or oxygen, are practically equal." We might add that all anesthetic mixtures containing ether and oxygen in certain combinations have inherent possibilities of explosion. The regulation of dosage to avoid, entering the now known explosive inducing range, should therefore be borne in mind.

The manufacture and purification of cyclopropane,(C_3H_6)—a hydrocarbon gas — has been recently developed by Wardell, and the gas is now offered for anesthetic purposes. Reports given indicate that a satisfactory technique of administration has been worked out in different clinics, and increasing use will determine its place in the anesthetic list. It is an explosive gas, although said to be less so than ethylene.

The beginning of the use of local anesthetics for topical, regional and spinal use dates from the discovery of cocaine by Niemann in 1859, application of this discovery to general surgery (eye) by Koller in 1884 and its use as a spinal injection by Professor Bier, Tuffeir, Jonnesco, and many others. Today its revival in more effective form is the result of much trial and effort and in this perfecting of technique, credit is due to Labat, Pitkin and other painstaking investigators.

Discussion of local anesthetics comes within the scope of this paper only to emphasize the use of certain drugs, such as sodium amytal and other barbituric compounds, administered the night before for the double purpose of giving the patient a good night's sleep and insuring detoxication of the novocaine or spinocaine used. Ephedrine sulphate, gr. ¾ (adult) given twenty minutes before the lumbar puncture, affords protection against a fall in blood pressure. It is non-toxic and can be repeated if the blood pressure falls after the injection, indication for its use being a drop of 20-30 m.m. reckoned from the patient's original pressure.

The combination of gas analgesia with spinal or regional anesthesia in the psychically disturbed patient, and ability to supplement with inhalation anesthesia in cases where the local injection is unsuccessful or the anesthesia period insufficiently long for certain operations; are factors in giving more flexible control of this type of anesthetic. Pitkin emphasized the role of "psychic anesthetist" and rightly so, as the ability to keep the patient relaxed and comfortable mentally, by suggestion, is an art; useful alike in the induction stage of all anesthetics, but of paramount importance in types of anesthesia in which consciousness is not abolished. The taking and recording of blood pressure readings and keeping an accurate chart of the patient's reaction, is a necessary part of the administration technique.

Oxygen inhalation will successfully combat "the breathless feeling" and nausea some patients have shortly after a spinal injection. The giving of oxygen and carbon dioxide mixtures has successfully raised blood pressure 10-15 m.m. and makes the patient more generally comfortable; inhalations of 3-5 minutes usually sufficient, can be repeated if necessary. However, in regard to control of blood pressure, ephedrine is decidedly the most effective agent.

Synergistic methods — a logical outgrowth of the use of premedication drugs, covers a wide range of past and present investigation, the influence of which cannot now be fully evaluated.

The use of synergizing combinations is based on the fact, as stated by Meyer and Gottlieb, "That if the weakening or prevention of the action of one drug by that of another be called antagonism, the one-sided or reciprocal augmentation of such action may be called synergism." The theory of synergism also seems to confirm Burg's law, that, "The sum of the combined action of one or more narcotics, administered simultaneously or shortly after each other, produces a much more prolonged effect than when the total equivalent quantity of either one narcotic had been administered alone. This increased action is particularly marked when the two narcotics have different cell receptors or belong to different chemical series, in which case the two drugs seem to potentiate each other and that a dose of any one drug acts much more markedly when given in frequent small doses than when administered at once in a single dose."

We now recognize two states of synergism — synergistic anesthesia, when unconsciousness is established — synergistic analgesia, when the subject is conscious but rendered indifferent to pain and is comfortable mentally.

The synergism of morphine-scopolamine, morphine-atropine, (in patients with a morphine intolerance, pantopon is substituted) used alone to control pain or used with general anesthetics to secure analgesia and anesthesia as desired, is well-known and widely applied; not so well-known is the synergistic action of magnesium sulphate. In 1914 Meltzer demonstrated the anesthetic properties of this drug and defined its synergistic action as follows: "When after the administration of very small amounts of ether, insufficient to cause anesthesia, an inefficient amount of magnesium sulphate is injected intramuscularly, a profound anesthesia results which can be maintained for hours."

Gwathmey, following up Meltzer's work, carrying on investigations in regard to the synergistic action of magnesium sulphate and other agents, published in 1921 the result of his research and evolved the application of synergism and colonic ether to the production of analgesia and anesthesia.

Briefly stated, his contention is, that while magnesium sulphate used alone is an unsafe anesthetic, when used for its synergistic properties it is not only harmless but one of the most effective of known anesthetics. He states that morphine given with magnesium sulphate synergizes gas-oxygen, deepening the effect so that nitrous oxide may be cut down and the oxygen increased; used with ether it allows for a reduced amount of that drug, ⅓ to ½, with no decrease in the efficiency of the anesthetic. It is his belief that given with morphine it seems to act mechanically by holding it in contact with tissues longer than morphine alone is able to maintain such contact. For instance, ⅛ gr. of morphine given in 2-4 c.c. of 25 per cent solution of chemically pure magnesium sulphate, is increased in value from 50-100 per cent as compared with the same amount of morphine given in sterile water." One hypodermic of the same mixture (magnesium sulphate and morphine) will relieve pain from 10-30 hours compared to 2-4 hours when sterile water and morphine are used."

Gwathmey emphasizes this value of magnesium sulphate to deepen the action and prolong the effect of morphine in its application to the post-operative comfort of the patient. He claims that the resulting prolongation of post-operative comfortable analgesia is a valuable factor in lessening the patient's discomfort, in regard to nausea, vomiting and gas pains and in minimizing surgical shock.

Importance is attached by him to the usefulness of this synergistic combination with colonic ether. This method, although as pictured by its adherents leaves little to be desired, has not taken the place of inhalation anesthesia in general surgery, but has its widest usefulness in obstetrical work.

In this particular field it is acknowledged that the formula and technique elaborated by Dr. Gwathmey and his co-workers is an important contribution. The last formula representing the end result of much investigation is:

Formula:	Quinine alkaloid	gr. 20
	Alcohol	40 minims
	Ether	2½ oz.
	Petrolatum liquid or Olive oil	4 oz.

Technique: I. Three intramuscular injections of magnesium sulphate — each 2 c.c. of 50 per cent solution.

II. An injection of morphine sulphate gr. ¼ given with the first injection of magnesium sulphate *only*.

III. Rectal instillation of the above formula.

In the New York Lying-In Hospital, Gwathmey's method of colonic ether has been successfully used in a large series of cases. The opinion expressed is that it affords protection to both mother and child and is

acceptable and safe for use in all types of cases. While it seems logical that this formula representing such a great amount of research and practical work should be favorably considered, it is also true that there is a decided difference of opinion as to the entire safety of magnesium sulphate. Variations of this technique, to best suit the beliefs and need of different surgeons, therefore exist; in some cases modifying the dose of morphine or giving it in divided doses with scopolamine instead of magnesium sulphate; the use of inhalation anesthesia rather than colonic instillation, et cetera.

While indications for use of rectal ether-oil (in various accepted combinations) are broadly given; as the insane, neurotic patient, plastic and orthopedic surgery, its widest and most useful application is in obstetrics.

In evaluating this method of anesthesia, study of its contra-indications should engage our attention. It should not be used in patients with any history or evidence of rectal lesions, colitis or diabetes. Magnesium sulphate combinations used advisedly in kidney diseases. The greatest emphasis should be placed on the selection of precise technique which will afford protection against post-operative colitis or more serious complication of ulceration of the colon.

The introduction of barbital (veronal) by Fischer and Von Mering in 1904 was followed by its extensive use as a hypnotic, which led, later, to investigation and use of the barbituric compounds. Of this group amytal, or rather its sodium salt, is now used successfully as a hypnotic and basal anesthetic, and an almost voluminous amount of data is available for study. As all barbituric compounds possess with differing manifestations, the ability to produce hypnosis, and with increased dose basal anesthesia, a short analysis of sodium amytal may be helpful in evaluating the usefulness of other members of this group used for similar purposes.

Sodium amytal as stated, is used as a preliminary hypnotic or a basal anesthetic to general anesthetics, and is also used with spinal anesthesia. The method of administration is intravenously, orally or by rectal instillation with ether-oil, supplemented in the first two methods with any desired inhalation anesthetic, gas-oxygen usually preferred. The basis of dosage is 1/10 gr. per pound of body weight, but it is now generally conceded that the given amount should not exceed 9 to 12, or, at most, 15 grs. This is usually combined with $\frac{1}{6}$ to $\frac{1}{4}$ gr. of morphine, atropine 1/150 to 1/200 gr. given one-half to one hour before the patient goes to the operating room.

The intravenous method is said to afford better control of dosage as the injections can be stopped when the desired effect is obtained; the fluid must be given slowly, 1 to 2 c.c. per minute. There is apparently little difference between the two methods except in the case of oral administration it takes from 5 to 10 minutes longer for hypnosis to appear and a longer time for it to wear off. It is conceded that respiratory depression is more likely to occur when a full dose (9 to 12 grs.) is given orally at one time, and the usual practice now is to give the drug in divided doses, 1 capsule (grs. 3) every hour until the desired effect is obtained, up to one hour before operation. Lundy advises the use of the intravenous method when an amount over 10 grs. is given. He also ad-

vises that in infants the drug can be given in capsules by rectum, ½ gr. to a child under 1 year, 1 gr. to a child between 1-2 years and about 3 grs. for children 2-3 years. If the patient is old enough to swallow, oral administration is satisfactory.

Weighing the relative value of the intravenous over that of the oral method; it seems that the oral method, because of its more simple application and being extensively used, is largely superseding the intravenous method for routine work, the latter being used when special need indicates it, as giving more efficient control of a particular case.

The advantages of sodium amytal are a quiet induction with a lessening of psychic fear, prolonged post-operative sleep, lessened memory of painful post-operative events, nausea and vomiting usually absent. Detoxication of anesthetics, especially local anesthetics, is obtained.

Although sodium amytal can be used as indicated in general surgical work, it is chiefly useful in giving pre-anesthetic control of the nervous, neurotic patient. It is also considered by some authorities to be of great value as a pre-medication drug in patients suffering from Basedow's disease. Sodium amytal is acknowledged an efficient agent in obstetrical anesthesia, affording a longer duration of pain control — an important factor in this work. Its use in spinal and regional anesthesia has already been emphasized.

Lundy states the disadvantages as the possible fall in blood pressure, cyanosis and shallow breathing, in some patients marked delirium, edema of the lungs due to shallow breathing and the inability of the patient to raise mucus after such operations as thyroidectomies and tonsillectomies. These damaging effects are more likely to occur when a higher dose is given (20-30 grs.). Wider use of the drug has demonstrated the danger of higher dosage, and these untoward effects are now rarely seen.

Nursing care post-anesthesia is emphasized particularly in regard to prevention of respiratory obstruction from the falling back of the tongue. The patient should be kept on one side so the tongue will fall forward and an airway inserted if necessary. Due to prolonged sleep, care should be exercised in the use of hot water bags, and gentle restraint used to take care of varying degrees of mental disturbance, which may occur.

Sodium amytal is considered a valuable drug for non-surgical cases by Lundy and others. In smaller doses it is a valuable hypnotic, used with benefit in psycho-neurotic cases, helpful in insomnia, giving restful sleep and used widely and efficiently in the control of post-operative psychosis. It is judged less dangerous and more efficient than other agents formerly used, in controlling the intractable pain of burns and injuries. It is used in tetanus to bring the patient under control so that serum and antitoxin can be given. In the case of gastric crises, with vomiting, sodium amytal, given intravenously, lessened pain and controlled vomiting for several hours at a time. In severe hiccoughs the spasms uncontrolled with oxygen and carbon dioxide alone, yielded to the use of sodium amytal followed by inhalation of gas mixture. Insane patients, uncooperative, nervous and excitable, given small doses of sodium amytal, 5-9 grs., were rendered cooperative, for the extraction of teeth. The drug seems to allay the intense discomfort of pruritus.

In 1930, Lundy writing of sodium amytal also mentions using sodium nembutal (pentobarbital) as a hypnotic and basal anesthetic. In 1931 Barlow and his co-workers (Western Reserve University, Cleveland), with the hope of definitely determining the usefulness of barbiturates conducted an investigation of all those included in the pharmacopeia or of recognized usefulness by other investigators. The result of this research has proved of great value in establishing the pre-medication efficiency of different barbituric compounds. "Barlow's grouping of these drugs, as to 'pre-medication efficiency (high to low) judged by the ratio of effective to lethal dosage, the minimal duration of hypnosis to complete recovery, and fewest disagreeable side effects' is as follows: Pentobarbital, Avertin, Dial, Allonal, Neonal, Phanodorn, Amytal, Luminal, Barbital (veronal), Pernocton." (Avertin included in this series is not a barbituric compound.)

Barlow emphasizes pentobarbital, as the safest and most efficient of the group. Recent publication of the clinical experience in the use of this drug, on the surgical service of the University Hospitals of Cleveland, confirms this favorable opinion.

In evaluating the barbituric compounds, in relation to anesthetic efficiency, it is now conceded that while certain of the group are of value for surgical work, the usefulness of others is chiefly that of sedatives and hypnotics. All investigators stress the fact that safety lies in the use of barbiturates as basal anesthetics only, supplementing local or inhalation drugs to produce surgical anesthesia. As the modern trend of anesthetic procedure is towards securing comfortable analgesia, or amnesia, to the patient, it seems reasonable to expect that further research will result in making available still more acceptable barbituric compounds.

Tribromethyl alcohol, known in this country under the trade name of "Avertin," was first produced by two German research workers, Duisberg and Willstaetter. The drug used successfully in Germany (1926), as an anesthetic was introduced into United States several years later; since which time it has taken a prominent place, as a basal anesthetic.

In form the drug is a white crystalline salt, easily dissolved in distilled water at a certain temperature (40 C.). In higher doses it acts as a basal anesthetic, in lower doses as an hypnotic. Avertin is changed chemically in the body, being detoxified in the liver, through union with gluronic acid, and is excreted mainly through the kidneys.

As stated, the drug is a proprietary medicine put out as "avertin fluid," a solution of avertin in amylene hydrate and with it is supplied a vial of Congo red test solution and a dropper. The book of instructions which comes with each package contains plain, explicit rules for its administration; together with a series of dosage tables worked out on the basis of milligrams per kilogram of body weight, with calculated amounts of distilled water to form a two and one-half per cent solution.

"A dosage chart computed on the basis of body surface area" worked out in the department of surgery of the Yale University School of Medicine, has been recently "presented as a safer method for determining the dosage of avertin, for the individual patient, especially in reference to patients of relatively good health, but of abnormal weight."

While the method of using avertin is simple, a rectal injection, particular care should be exercised both in determining the correct dose for the individual patient and in preparing the solution. If the solution is heated above 40° C. decomposition occurs, hydrobromic acid is split off and dibromacetaldehyde is formed which causes marked irritation of the intestinal mucous membrane, with possible resulting colitis a more serious ulceration of the colon. To safeguard against this, just before injection a small amount of the solution is tested with congo red aqueous test-solution — and a pure orange red color should develop. If the color becomes blue or violet (indicating impurities) the solution is discarded. For purposes of safety it is a wise practice to have the preparation checked by two anesthetists, and the one who administers the drug be required to return the test solution for further checking.

The simplicity of administration must not mislead us as to the importance of selecting the dosage, affording the greatest protection to the individual patient. It seems apparent that the mass of avertin is absorbed quicker than the water in which it is dissolved and once the injection is given the action depends on the natural disintegration of the substance in the body, this in turn depending on the acid-alkali state and intensity of body metabolism. It is probable that older patients reach the state of anesthesia with smaller doses; younger patients with more intensified metabolism require larger doses; and children, because of active metabolism, seem to tolerate the largest dose of all. The over-weight patient should be underdosed. This rule also applies to patients with large abdominal tumor or ascites.

The rectal injection, thus carefully determined, prepared and checked, is given 25-30 minutes before the operation, preferably with the patient in bed. Adult patients are usually given morphine gr. $\frac{1}{6}$ and atropine $\frac{1}{150}$ five minutes before the injection, in the ordinary patient. In the psychically disturbed patient when it seems wise to disguise the procedure as an enema, the hypodermic is given when unconsciousness occurs, usually 4-8 minutes after the injection. Blood pressure is taken before the injection, and at regular intervals thereafter.

After injection unconsciousness occurs quickly and quietly. Blood pressure usually falls 10 to 30 m.m. If relaxation of the jaw and tongue occur an airway is inserted. Patient is removed to the operating room and prepared for the operation. If the depth of anesthesia is insufficient, evidenced by reflex movement during surgical hurt, supplementary gas-oxygen anesthesia is used. In our experience light gas-oxygen anesthesia, practicing rebreathing, corrects the lowered blood pressure and gives efficient control of respiration. If any untoward depression or cyanosis occur before the patient is removed to the operating room an inhalation of oxygen with 5 per cent carbon dioxide or a few whiffs of ether will usually correct the condition. If this is not successful and the condition seems serious the use of ephedrine $\frac{3}{4}$ gr. for the adult, or caffein-sodium-benzoate grs. $7\frac{1}{2}$ are used. Killian advises the use of alpha-lobelin grs. $\frac{1}{20}$ for child, $\frac{3}{20}$ grs. for adult, given intramuscularly in cases of severe respiratory depression. In our experience oxygen and carbon dioxide have been sufficient. Almost invariably with the institution of light gas anesthesia, the blood pressure returns quickly to the normal level.

Avertin's greatest value is reducing the psychic distress of nervous patients and frightened children. The ease and quickness of falling asleep has already been mentioned. Surgical anesthesia is maintained with lower concentrations of gases — if ether is necessary for deeper relaxation, smaller amounts are used. Post-operative, the prolonging of the quiet period is a favorable feature, lessening nervous shock and blurring the memory of pain provoking procedures; nausea and vomiting lessened. Avertin is not irritating to lung epithelium, causing no hypersecretion of mucus; it therefore should protect against pneumonia, and it is our impression that this is so.

Avertin as a basal anesthetic has a wide application, and is used for practically every type of surgical procedure — from major operations to control of patients during painful dressings. The selection of the supplementary anesthetic (local or general) and its method of administration, depends on the nature of the operation, and the choice of the individual surgeon.

Avertin is of particular value in neurological surgery, on account of the quiet breathing induced and non-interference with intra-cranial pressure; important factors in securing comfortable control in difficult cerebellar tumor operations. For operations on the nose, face and neck, it gives a better field for the surgeon. A word of *warning*, in throat operations is the post-operative danger of blood getting into the trachea, and causing asphyxiation, due to the patient's inability to expel the fluid. In thoracic surgery where it is desirable to have the cough reflex retained the drug is given advisedly. In orthopedic surgery it is extensively used and liked. In thyroid work, avertin given, disguised as an enema, makes the technique of "stealing the gland" much more simple.

Avertin, alone or supplemented with nitrous-oxide-oxygen, allowing no ether in the apparatus, is particularly indicated in operations necessitating the use of the cautery or diathermy. If ether is necessary, an element of explosive danger is introduced, and spinal anesthesia affords the best protection.

The contra-indications for the use of any except guarded doses — that is not *above* 80 milligrams and *lower* as deemed advisable are: patients suffering from dehydration, anemia, impairment of the renal function, heart defects with a tendency to, or already established, low blood pressure and negroes because of lessened tolerance.

Direct contra-indications to its use are broadly given as patients suffering from severe blood diseases, organic diseases of the liver, rectal lesions, bilateral diseases of the kidneys, advanced tuberculosis. In children its use is contra-indicated in severe nutritional diseases, heart lesions, and whooping cough, with asphyxial paroxysms (inability to expel mucus a factor of danger).

The use of avertin in non-surgical cases will doubtless be extended in the future. At present favorable reports are given in regard to efficient control of convulsive seizures in tetanus, and eclampsia. In the agitation states of Basedow's disease (non-surgical) the drug has proved helpful in combating motor unrest. In psychiatry avertin is of great value in controlling severe paroxysms.

As avertin is apparently non-irritating to the intestinal mucous membrane, and is not accumulative in effect, injections can be repeated, 8-10 hours or oftener, according to the duration of sleep, as indicated for control of the patient.

SUMMARY

While realizing that any attempt at an evaluating summary would on account of the mass of material involved, be inadequate, the following conclusion may prove interesting.

(1) Broadly, the greatest recent advance in anesthesia has come about through research, as to the nature and application of premedication drugs and basal anesthetics — avertin being considered by many to be the most important later event in anesthesia.

(2) The perfecting of gas-oxygen apparatus, in which connection emphasis should be placed on the elaborating of carbon dioxide filtration; a method affording almost precise control of respiration, and greatly lessening the amount of anesthetic gases. More efficient apparatus for giving ether.

(3) The wider application of local anesthetics and development of more efficient technique in their use. In this connection the role of the nurse anesthetist, in keeping the patient comfortable, taking blood pressure, et cetera, is emphasized.

(4) Increasing perfection of methods of administration, combining premedication drugs with inhalation anesthetics, and a wider variety of methods for their use; thus steadily evolving a more flexible control of patients under anesthesia — this is a great step forward.

(5) A constantly growing realization, by the laity, that anesthesia can be comfortable as well as safe, has established a feeling of confidence, the beneficial effect of which can hardly be evaluated. The ability to give patients post-operative rest, with mental blurring of pain, lessens nervous shock and makes convalescence more comfortable.

(6) More scientific control of modifying and protecting factors in anesthesia; such as: preanesthetic preparation, psychic control, comfortable position on the table, control of humidity and temperature of the operating room, precise means to combat shock from any cause, et cetera.

(7) Knowledge of the explosive range of certain combustible anesthetic mixtures, and utilization of *safety* measures to insure against possible accident.

(8) Advancement in regard to more informative anesthetic charts. The correct filing of data, so that research may be carried on in conjunction with clinical facts. Wider dissemination of knowledge on the subject, through medical journals and special publications.

(9) The event of two new general anesthetics, divinyl ether and cyclopropane gas. Inadequate knowledge of their use makes impossible any prediction as to future place.

(10) A general raising of educational standards, and definite recognition of anesthesia as specialized service. Our chief concern is now and always shall be to afford such education and experience to the nurse anesthetist as will enable her to skilfully carry out any desired anesthetic procedure, and correctly interpret the behavior of the patient under anes-

thesia. This in the final analysis means ability, not only to keep the patient in the zone of anesthesia as best insures the safe accomplishment of the required operation, but implies, in case of need, knowledge and quick application of such remedial measures as will secure anesthetic safety to the patient.

In evaluating available literature on anesthesia we will as a well-intentioned, progressive group, have a deep appreciation of those who have made such fine contributions, and resolve to take a more active part as contributors to the sum total of useful information in this important subject. A department of education, which we hope to establish within our "National Association," will afford means of facilitating this essential work.

In these days of changing drugs and methods — many so glowingly set forth by enthusiasts — as nurse anesthetists we will be wise indeed to heed, in moderation, the words of the wise old saw:

"Be not the first by whom the new is tried,
Nor yet the last to lay the old aside."

Mrs. Mae B. Cameron Honored

Mrs. Mae B. Cameron was the guest of honor at a gathering in the Marine Ballroom of the Edgewater Beach Hotel, Chicago, on the evening of May 1st, 1935. It was attended by two hundred of her friends and associates.

The party was planned to afford an opportunity to celebrate the completion of Mrs. Cameron's twenty-five years of service to Ravenswood Hospital, and to anesthesia.

A platinum watch set with thirty-two diamonds, was presented by the Hospital Staff as a token of gratitude and appreciation; also a testimonial from the Medical Staff and Hospital Directors in appreciation of her loyalty and faithful service to humanity.

Mrs. Cameron's interest in the National Association of Nurse Anesthetists has been outstanding, greatly to the benefit of the organization, and many are the lives she has enriched by her encouragement and friendship.

AVERTIN ANESTHESIA—A REPORT OF 538 CASES

DOROTHY M. HOADLEY
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HISTORY

Avertin, or tribromethanol, was first prepared in 1923 by Willstaetter and Duisberg by the reduction of bromal hydrate through a process of yeast-sugar fermentation. Four years later it was first used as an anesthetic by Eichholtz. In December, 1927, avertin was first introduced into this country by Ronan of New York City, and to him goes the distinction of making in American literature the first report of its use.

CHEMICAL AND PHYSICAL PROPERTIES

The pure drug is a colorless, crystalline substance which is soluble in water up to about 3½ per cent at a temperature of forty degrees centigrade. It is prepared commercially by the reduction of bromal hydrate with alcohol in the presence of aluminum ethoxide as a catalyst.

When solutions of this drug are heated to a temperature exceeding 40° C. (104° F.) it slowly decomposes, forming dibromacetaldehyde and hydrobromic acid, which will cause a certain irritation to tissue, thus impressing the importance of care in the preparation of the solution before administration into the anal canal. The products of this solution when containing the dibromacetaldehyde are very toxic, and in sufficient concentrations have been reported as causing a necrosis of the rectal mucosa, hence it is essential to use freshly prepared solutions.

Avertin is supplied commercially in the form of a concentrated fluid, the use of which necessitates measuring the desired dosage. This concentrated solution is obtained by the addition of amylene hydrate, which increases the solubility of avertin. Avertin fluid contains one gram of avertin and 0.5 gram amylene hydrate per cubic centimeter. Amylene hydrate is absorbed and has no pharmacological effects other than a slight respiratory stimulation with mild sedation. The odor sometimes produced by the absorption of amylene hydrate has been the basis of criticism of avertin. Others have maintained that amylene hydrate causes more excitement and irritability during the state of reaction, but it is now the general consensus of opinion that these effects are inconsequential. Personal observation shows that the reaction period is quiet in nearly one hundred per cent of the cases.

PHARMACOLOGY

Dosage: It has been demonstrated that the lethal dose of avertin in animals is from 75 per cent to 100 per cent in excess of the anesthetizing dose. Practically all of the deaths of human beings from avertin have been in instances where the dose of the drug has exceeded 150 mgm. per kilo body weight. The makers of avertin recommend that the dose never exceed 100 mgm. per kilo and with a few exceptions this dose has never been exceeded here. The largest single dose ever administered in this hospital was 133 mgm. per kilo. This amount was given to a seven-year-old girl who slept only two hours and forty minutes and had no ill ef-

fects. The smallest dose administered was 60 mgm. per kilo on a number of occasions. It is usually safe to repeat a dose of avertin in about four hours. Smaller doses of avertin have been repeated in less time, as in brain cases, where patients showed a marked tolerance for the drug. The dosage depended on the type of patient and in this series of cases a full 100 mgm. dose was repeated in four hours and thirty minutes, and the patient reacted in about six hours. Children are always more tolerant to the action of drugs than adults, and elderly people are less tolerant than middle aged people.

ABSORPTION

Avertin is rapidly absorbed in the rectal mucosa. The highest concentration of the fluid in the blood stream is reached in about twenty minutes, and all the drug is absorbed in about two hours. The highest anesthesia level is believed to be reached in thirty minutes.

EXCRETION

Avertin is excreted from the kidneys in combination with glycuronic acid. There appears to be no evidence of a hydrolysis in the body as might be indicated by the finding of bromides in the urine. The greatest concentration of the drug is reached in the urine in about four hours after administration, and it is excreted quantitatively in forty-eight hours. Experimental work in animals has failed to demonstrate any accumulative effect.

The excretion of the drug by the kidneys suggests a possibility of renal damage. Clinical and pharmacological evidence is against the existence of such. Shipley and Karns found no further decrease in renal function after the avertin was administered to patients with kidneys already impaired. Huntington reports an instance in which about 25 or 30 injections of avertin were given to a boy of nine years with tetanus and there was no evidence of residual renal damage. In this case the dose ranged from 60 to 100 mgm. per kilo. Ruge reported recently a death in which the autopsy findings revealed nothing of significance, except degenerative changes in the liver and kidneys. Our personal experience with kidney surgery under avertin anesthesia reports six cases: two were nephritic abscesses; two were nephrectomies; one a nephropexy; and one an exploration of the kidney region. All cases received 100 mgm. doses, and there were no ill effects during or following surgery. The use of the drug was debated upon in one instance due to the literature listing this type of work as a contraindication for the use of avertin. An eighty mgm. dose was given and gas anesthesia supplemented, with no disastrous effects.

There have been a few reports of avertin as an intravenous anesthetic but we have not attempted it here. When avertin is given by this method there is produced a profound narcosis immediately, but complete reaction occurs in about fifteen or twenty minutes. No bad effects have been reported from the intravenous administration.

TECHNIQUE OF ADMINISTRATION

Avertin is supplied in 25 or 100 c.c. bottles, together with a vial of Congo red aqueous test solution (1-1000) and a dropper. The patient is

weighed, and from the weight is calculated the dose of avertin fluid for any predetermined base. Convenient tables are furnished by the Winthrop Chemical Co., Inc., with the doses for all weights, and a given avertin base and the amount of distilled water necessary to make the desired 2½ per cent solution.

Recent investigation discovers a new scale for computing dosage, as was reported in Philadelphia by Miss Alice Hunt, Yale University School of Anesthesia. This scale is a body surface chart, which takes into consideration the height, in feet, of the patient, with the weight in pounds, to obtain a surface area, and thus get a correct dosage, which is thought to be more accurate for the individual patient.

When the correct dosage has been determined, the distilled water is heated to a temperature of 104° F. (40°C) in a closed flask. The amount of avertin fluid is measured in a graduated pipette and added to the water. The mixture is then shaken until all the globules disappear. It is at no time allowed to cool below 97° F. or else precipitation may occur and the entire solution must be discarded. The solution is tested immediately, before the rectal injection is started, by placing 2 to 5 cc. of the solution in a test tube, and adding one to two drops of a 1-1000 aqueous test solution of Congo red. A pure orange color should develop and any bluish or violet discoloration means that a certain amount of decomposition has taken place, and the solution should be discarded. Rectal injection is made slowly, in from five to seven minutes. Our personal observation has shown that rapid administration tends to produce cyanosis and a tendency toward respiratory embarrassment. Twenty to thirty minutes should elapse from the administration of the avertin fluid, and the transfer of the patient to surgery. The injection is usually made in the patient's room, and he need not know that anything other than an ordinary enema is being given. This is of great benefit especially with the highly nervous patient. They are most appreciative on recovery, and they require much less supplementary anesthetic. It is extremely important to prevent obstruction of the respiratory passages, and many advocate the routine use of the airway. The marked relaxation tends to cause the tongue to drop backward and obstruct the air passage. Here, it is well to mention the importance of the most rigid observation of the patient on the return to the ward, following surgery. There must be perfect air exchange, and there must be caution used in the post-operative administration of narcotics. Occasionally morphine has been administered, and the patient has had a marked respiratory embarrassment with cyanosis, not having sufficiently recovered from avertin anesthesia. This is especially noted in older people, who are quite debilitated, and show little resistance.

TYPES OF CONDITIONS FOR WHICH USED

Surgical cases included:

Brain		
Decompression	7	*
Abscesses	2	
Encephalocele	1	
Cerebellar exploration	1	
Gasserian ganglionectomy	2	

Plastic surgery on face and hands	2
Ligation carotid artery	1
Resection of maxilla	1
Excision parotid gland	2
Oral tumors (carcinoma)	6
Tooth extraction	3
Tonsillectomy	2
Sub-mucous resection	1
Mastoidectomy	10
Drainage antrum and frontal sinus	2
	†
Eye	10
including	
Trephine	
Iridectomy	
Enucleation	
Thyroid	6
Breast (radical)	6
Breast (simple)	3
Thoracotomy	1
	‡
Orthopedic	54
Bone graft (spine)	3
Spinal fusion	2
Laminectomy	2
Nerve transplantation	3
Gastric resection	1
Gastroenterostomy	2
Cholecystectomy	14
Cholecystectomy with other surgery	9
Appendectomy	60
Appendectomy with iliostomy	3
Appendectomy with tonsillectomy	2
Intestinal obstruction	8
Exploratory laparotomy	3
Kidney	6
Splenectomy	2
Hernias	14
Colostomy	2
Hemorrhoidectomy	2
Gynecological	251
Ectopic pregnancy	1
	‡†
Cystotomy	1
Ureterolithotomy	2

*Two cases required two doses of avertin at from 3 to 4 hour intervals and there was excellent anesthesia in both instances.

†No supplement.

‡It is definitely recognized that shock usually experienced in bone surgery is eliminated. It has been stated here that drop ether or nitrous

oxide is the better supplement, as ethylene is thought to cause more capillary bleeding.

‡†Patient 78 years of age—excellent anesthesia; no supplement.

In a medical case we used avertin for chorea, repeating the dose over a period of three days, with excellent results. The child was nine years of age. Avertin was used in a case of delirium tremens with good results. Two cases of tetanus outside of the hospital came under our observation, with one death and one recovery.

In the eye surgery, especially, it was noted that many patients with high blood pressure, as in one instance 220–120, had a drop in pressure to as low as 120–50, with no ill effects. There was no sign of shock. This was noticed in many hypertensive cases, also in a case where the carotid artery was ligated following a hemorrhage from a traumatic fracture of the antrum; blood pressure 170–100 with a drop to 114–58 and the patient's condition remained satisfactory. We wonder at what length avertin may be used outside of the surgical field.

SEX AND AGE

In this series of cases there were four hundred and thirty-seven females and one hundred and one males. The oldest patient was eighty-seven years of age and the youngest six weeks. The average age was thirty-two years. The youngest patient was given a dose of 117 mgm. per kilo body weight with no ill effects, and slept two hours and fifty minutes. The oldest patient was given a dose of 100 mgm. per kilo body weight, slept for six hours and forty minutes, and died without reacting. The cause of death was ascribed to cerebral hemorrhage. He had had a fractured hip and a body cast was applied. There were thirty-three patients between the ages of sixty and seventy years of age, given doses from 80 to 100 mgm. with no ill effects. Caution must be taken with these patients in computing the dosage, as their general physical condition varies considerably, and there is a decided difference in their tolerance for any drug. Thorough physical examination is necessary, and general muscle tone is found to be of value as a guide in determining the dosage. Those of the debilitated type will not tolerate the normal dosage of 100 mgm. The absorption is slow, and the anesthetic lasts over too long a period, thus necessitating precaution in regard to post-operative narcotics. Deaths reported were from generalized peritonitis, carcinoma of the sigmoid two days after reacting from the anesthetic, and two decompressions where patients were critically injured, and the older patient referred to earlier in this report.

PREMEDICATION

The drugs most commonly used were sedatives, such as sodium amytal, and nembutal, together with morphine and atropine, and in some cases hyoscine. It was impossible to demonstrate a definite reaction time in those patients receiving the heaviest premedication. Their sleep would cover from four to six hours with no ill effects. Waters and Muehlberger state that since avertin is a somatic rather than a psychic depressant, either hyoscine or some of the barbituric acid derivatives should be included in the pre-anesthetic medication.

INDUCTION

No patients, on being questioned following the anesthetic, have said that they experienced any unpleasant sensations during the induction of the anesthetic. They go to sleep quietly, much as in ordinary sleep, and often ask on reacting, when the operation is going to be performed. They feel that they have never taken an anesthetic, especially those who have had previous anesthetics administered. They lose the fear of going to sleep, and post-operative nervousness is lessened. In checking reports of cases here, they have not required as much post-operative narcotic, and we feel that there has been less nausea and vomiting.

SUPPLEMENTARY ANESTHESIA

Supplementary anesthetic was used in most of our cases for general surgery, even with one hundred mgm. doses, as it was considered only as a basal anesthetic. For minor surgery the avertin was very often sufficient. Either nitrous oxide, ethylene, or ether was used to supplement. Occasionally novocain was used, as in brain surgery or hernias. Supplement in over ninety per cent of the cases was very small and high percentages of oxygen were required. A few patients required complete anesthesia with the avertin, especially the highly nervous and those having had several previous anesthetics, or emergencies. In many cases supplement was needed only for a few minutes, such as to facilitate closure or as the peritoneum was opened.

EFFECT ON PULSE AND RESPIRATION

The characteristic change noted in the rate of respiration was a slight slowing in most instances. The pulse was frequently unchanged or became slower after the avertin was administered, but not alarmingly so.

BLOOD PRESSURE

Most observers report a slight drop in the blood pressure, with a rise to the pre-anesthetic level after about twenty minutes. We have noted that this drop is most noticeable in hypertension cases, and it may be absent, or it may rise, as in hypotension. The fall in blood pressure is thought to be due to the vasomotor depression. From our observation the thought has come to us as to the value of this anesthetic as a possible treatment in coronary occlusion. In this series of cases the greatest drop in blood pressure occurred in a case of hypertension. The reading was 205 systolic, 160 diastolic, at the beginning of the injection. The lowest point to which the pressure fell was 110 systolic, and 70 diastolic. This pressure never rose again above 140, while the patient was in the hospital. During the marked fall in blood pressure there was never any sign of shock, pulse ranging from 80-94. This same condition has been noted many times in similar cases. Most patients showed a slight fall in pressure averaging 13.8 mm mercury. Few showed a marked rise in pressure.

BLOOD CHEMISTRY

Blood chemistry is unchanged in most cases, except for a sharp rise in blood sugar. The rise is usually 10 to 30 mgm. per 100 cc., and usually falls to the pre-anesthetic level in from six to twenty-four hours.

LIVER

Because of its chemical similarity to chloroform, avertin has been studied with special reference to the possibility of liver damage. In dogs with normal livers, there was noted a slight impairment of liver function after receiving a 500 mgm. dose of avertin per kilo body weight. They reported an additional damage of liver function from 5 per cent to 35 per cent in dogs whose livers had previously been damaged by the administration of chloroform. The impairment in either case did not last more than twenty-four to forty-eight hours.

CATHETERIZATION

Forty-eight per cent of our cases were catheterized. It is felt that one reason for the high percentage in this series is that many of these patients had been ordered catheterized in a given length of time without regard to the amount of fluid intake, perspiration, or vomiting.

CYANOSIS AND STIMULANTS

Cyanosis was found in a small per cent of the cases under observation. As a rule it was very slight, and more noticeable where hyoscine had been used, or the patient was acutely ill and showed toxic symptoms. It is thought that if cyanosis is a very prominent factor, it is usually due to a relaxed jaw, or some obstruction to the free exchange of air. Stimulants used in our early use of avertin were caffein, sodium benzoate, ephedrin, adrenalin and carbon dioxide inhalations, but recent investigation and observation have shown that coramine is a better respiratory stimulant.

The February Anesthesia and Analgesia Journal states that coramine exerts a definite "awakening" influence on animals or patients under avertin anesthesia. It is necessary to use appropriate dosage, adjusting this to the depth of the narcosis. Unlike other agents, coramine increases the depth rather than the rate of respiration. It aids when carbon dioxide fails. As the drug does not show accumulation, repeated injections may be resorted to when indicated. Dr. Hans Killian, Freiburg, Germany, says, "When coramine fails to overcome a state of depression, one may consider that the cause of this depression is not avertin, so specific is the action of coramine."

REACTING TIME

The average reacting time in this series of cases was four hours and twenty minutes; the longest time was seventeen hours and fifty minutes. This last case was a patient who underwent a splenectomy in a desperate effort to stop the progress of an agranulo-blood dyscrasia. He was in very poor condition, and died the second day after operation. Several patients never went to sleep following avertin administration, until a supplemental anesthetic was given. They were very nervous, or admitted as emergencies, or they had had numerous other anesthetics and had a marked tolerance for any anesthetic. This was especially true of two osteomyelitis cases that had had six and eight anesthetics.

NAUSEA AND VOMITING

Nausea and vomiting were noted in 24 per cent of these cases in the first twenty-four hours. In no case has it seemed that nausea and vomiting could be attributed to the avertin alone. Several patients were vomiting when the avertin was administered, and did so throughout the operation, and for twenty-four hours after the operation. Observations in a comparison with other types of anesthesia seem to indicate that there is less nausea and vomiting, and general discomfort following the avertin anesthesia.

COMPLICATIONS

In this series there were only four disturbances of convalescence listed as complications, other than minor wound infections that could not possibly have any relation to the kind of anesthetic. There was one patient who developed a uremia but he had had a pre-existing chronic nephritis and a generalized peritonitis; another, a child with a generalized peritonitis who was acutely ill at the time of admission; another had a pulmonary edema; another a paralytic ileus and a broncho-pneumonia. Ether had been used as the anesthetic supplement in the latter case, and the patient made an uneventful recovery. There were fourteen deaths listed. All of these deaths, with the exception of two, occurred well after the patients had reacted from the anesthetic. One was a patient, eighty-seven years of age, who had a body cast applied for a fractured hip. He died in six hours and forty minutes after the administration of avertin without reacting. His condition was good until a few minutes before his death, and although his death was listed as being caused by cerebral hemorrhage, the anesthetic would certainly have to be taken into consideration as a possible cause of death. The second patient died in thirteen hours after the administration of a 100 mgm. dose, and the cause of death in this instance was clearly a fractured skull and increased intracranial pressure.

CONCLUSIONS

The chief advantages of avertin as a basal anesthetic are, the avoidance of psychic shock, perfectly comfortable induction, absence of depressing effects on the circulatory and respiratory systems, low toxicity and complete amnesia. The patients indorse it heartily.

The contra-indications are extreme cachexia, advanced diseases of the liver and kidneys, and ulcerative conditions of the rectum.

The popularity of avertin anesthesia is shown in the literature each month from different anesthesia departments of the country. In the March and April Anesthesia and Analgesia for 1935, Prof. Desmarest of Paris, France, makes this statement in speaking of the use of evipan anesthesia: "Personally I believe that the vogue of evipan will not last, but, that basal anesthesia by means of tribromethanol (avertin) combined with nitrous oxide-oxygen, will long continue to enjoy its legitimate success. Doubtless the method of combined anesthesia in which avertin is used with nitrous oxide-oxygen will not, any more than other methods of anesthesia, secure the approval of all surgeons; for there is no method of anesthesia that does not have its detractors; but this method will gradually obtain the preference of patients and will be demanded by them."

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Read at the April, 1935 meeting of the Dallas, Texas Association of Nurse Anesthetists.

CONDENSED REPORT
of the
PENNSYLVANIA ASSOCIATION OF NURSE ANESTHETISTS

Annual Meeting, Philadelphia, Pa., May 8-10, 1935

MARIAN L. ROBINSON, *President*

The following officers were elected for the year 1935-36:

President—Miss Marian L. Robinson, Pennsylvania Hospital, Philadelphia.

First Vice-President, Miss Katherine Plowman, Harrisburg Hospital, Harrisburg.

Second Vice-President, Miss Catherine Yarnall, Reading Hospital, Reading, Pa.

Secretary-Treasurer—Miss Rose G. Donovan, Mount Sinai Hospital, Philadelphia.

Trustees (2-year)—Miss Edith Abery, Harrisburg Hospital, Harrisburg.
Miss Ruth Haberstroh, Mercy Hospital, Altoona;
Mrs. Theresa McTurk, Metropolitan Hospital, Philadelphia.

Trustees (1 year)—Miss Janet Dougan, Hamot Hospital, Erie;
Miss Elizabeth Leister, Clearfield Hospital, Clearfield;
Miss Grace Williams, Allegheny General Hospital, Pittsburgh.

Reports were read by the Chairmen of the following Districts:

District No. 1, Chairman, Mrs. Theresa McTurk, Metropolitan Hospital, Philadelphia.

District No. 2, Chairman, Miss Edith Davis, Allentown Hospital, Allentown, Pa., (no report).

District No. 3, Chairman, Miss Mathilda Cavan, Mercy Hospital, Wilkes-Barre.

District No. 4, Chairman, Miss Katherine Plowman, Harrisburg Hospital, Harrisburg.

District No. 5, Chairman, Miss Ruth Haberstroh, Mercy Hospital, Altoona.

District No. 6, Chairman, Miss Grace Williams, Allegheny General Hospital, Pittsburgh, Pa.

District No. 7, Chairman, Miss Ida Stewart, Titusville Hospital, Titusville, Pa.

District No. 8, Chairman, Miss Maude Anderson, Elk County General Hospital, Ridgway, Pa., (no report).

During the year 1934-35 the Pennsylvania Association has been particularly active, and interesting meetings have been held in the various districts. Among the reports of the districts, the following was sent in from the Philadelphia District No. 1:

"During the year our meetings have been held the second Monday of each month. They have been well attended, and the following speakers have appeared on the programs:

Dr. M. Segal, "Fatalities Resulting from Spinal Anesthesia"

Dr. Thomas MacGreagor, a research scientist, "The Extraction of Nitrogen from the Atmosphere by Mechanical Means"

Dr. Edward Beach, "Preliminary Medication"

Dr. James Cameron, "Dental Anesthesia"

Dr. Camile Stam, "Anesthesia in Obstetrics"

Dr. J. C. Hirst, "Obstetrical Anesthesia"

District meetings of this nature are particularly valuable, and it is to be hoped that the other districts will be able to report similar activities next year.

An application by the Pennsylvania State Association of Nurse Anesthetists for membership in the state division of the National Association was read and resolution covering same passed unanimously.

A number of changes in the constitution and by-laws were acted upon. Each member of the Pennsylvania state organization will receive a copy of the constitution and by-laws in their present form.

TREASURER'S REPORT

Balance on hand September 19, 1934		$220.47
Receipts:		
Dues		387.00
		$607.47
Disbursements:		
Transfer of dues to National	$220.00	
Transfer of fees to National	8.00	
District dues	45.00	
Salaries	26.00	
Postage and Supplies	22.07	
Auditing	25.00	
Parliamentarian	35.00	
Printing	15.10	
Miss Walton—expenses since 1931 for organization	122.43	
Check tax	.22	$518.82
Balance on hand May 5, 1935		$ 88.65

All bills paid to date except $3.75 due District No. 2 (refund not made—awaiting election of officers).

ROSE G. DONOVAN
Secretary-Treasurer

PRESIDENT'S ADDRESS

MARY E. WALTON, R. N.
Mercy Hospital, Pittsburgh, Penna.

The Pennsylvania Nurse Anesthetists were organized in the fall of 1931 and each year has brought forth an added interest in the educational activities of our Association. We are honored to have been invited to meet with the Pennsylvania Hospital Association, and we have a feeling that a close cooperative spirit should exist between the two organizations. We have many problems in common, and as we are greatly interested in the protection of the patients in our institutions, we wish to identify ourselves as co-workers with the hospital administrators and the doctors in the service to the community in which we reside.

The objects of the Pennsylvania Nurse Anesthetists Association are to advance the science and art of anaesthesiology, to develop educational standards and technique in the administration of the various anesthetic drugs, and to provide the surgeons and the hospitals with a group of well trained, efficient women.

The early age of anesthesia is represented by an example of the "sleeping sponge" which was described by Theodoric in 1490. This consisted of a sponge saturated with a strong decoction of opium, hyoscyamus, hemlock, mandragora, and unripe mulberries, mixed with the seeds of lettuce, dock, and water-hemlock. These substances were boiled with the sponge and when complete absorption of the liquid had taken place it was allowed to dry. When an anesthetic was desired, the sponge was dipped in hot water for an hour and then applied to the nostrils of the patient and left there until he had fallen asleep. The procedure has long since been discarded and supplanted by modern methods. The first actual instrument or apparatus devised for the inhalation of an anesthetic was devised by W. T. G. Morton. He used it when he administered the general anesthetic for an operation performed by Dr. J. C. Warren at the Massachusetts General Hospital October 16, 1846.

About the same time, an apparatus for the administration of ether was devised by William Squire of London, and later an apparatus was devised by Snow in 1847. Until that year no real scientific apparatus had been invented for administering ether. Snow, who was an earnest and enthusiastic individual, renewed his research and in 1848 published "Experimental Paper on Narcotic Vapours." About the same time he perfected his well-known chloroform inhaler which, with modifications and improvements, remained in use for many years.

Following Snow came Clover, who in 1862, published an account of a chloroform apparatus by means of which he regulated the percentage of vapour administered. For minor operations Clover found that the administration of nitrous oxide gas with his apparatus proved more effective. The gas-bag, which was large, was conveyed on the back, the tube to the inhaler passing over the shoulder. Later, in 1877, Clover introduced a portable regulating ether inhaler, by means of which he

claimed that ether could be given rapidly and more safely. In 1883 an apparatus was devised by Dudley Buxton for administering ether per rectum, and was first used at an operation performed by Joseph Lister. The Vernon Harcourt inhaler for administering chloroform with a mixture of air and chloroform, which is automatically limited to a maximum strength of 2 per cent, was described by the inventor in 1903. Dudley Buxton's improved chloroform inhaler, which consists of a large Junker's bottle, and a glass face-piece, to which a metal ring carrying the air supply tube is attached, was again an improvement on all of the earlier patterns. Among the early machines used for the administration of nitrous oxide and oxygen is that devised by Rumboll-Birch, which has a face-piece fitted with a regulating stop-cock which permits the patient to inspire nitrous oxide or oxygen, or a combination of those gases in different proportions.

Later in the history of anesthesia, the administration of anesthetics was relegated to medical students or to first-year internes, both of whom were lacking in special training. The available drugs and the ones most commonly used were ether and chloroform. During this period, there was no particular interest in specialization or in the development of anesthesia. Many unfortunate complications arose during and following operations which could be generally attributed to a lack of knowledge and proper training on the part of the anesthetist to provide a safe and complete anesthesia.

The advent of the nurse anesthetist dates back many years in the various clinics of the United States, such as the Mayo Clinic, where it is found that Miss McGaw served as their first nurse anesthetist in 1910. Other hospitals throughout the country displayed a similar interest. In our own institution, the Mercy Hospital, Pittsburgh, Pa., our records show that the first attempt to establish the nurse as a trained anesthetist was introduced by Dr. X. O. Werder, Gynecologist, who selected Miss Gartland in 1906, a graduate of our own training school. She continued in the capacity of his anesthetist for many years.

The first active step toward the development of the nurse anesthetist as a group was during the World War. During this period she proved her value to the various surgical units. From this period there developed a strong tendency to establish the nurse anesthetists and they have since proven themselves competent to carry on the work successfully. The interest afforded by such opportunities to graduate nurses added stimulus to this specialization and inspired the gradual development of the various recognized schools of anesthesia. The school and the individual nurse anesthetist have tried to keep pace with the rapid developments in medicine. It is through this organization that definite progressive steps are going to be taken which will prove beneficial to the hospitals, the doctors and the members of our organization.

In the past ten or twelve years great improvements have been made in the technique of anesthesia. The state of apprehension concerning the problem of shock and other anesthetic complications, which so frequently confronted the surgeon and the anesthetist following prolonged operations, is rather the exception at the present time. Intensive study and

long experience have been invaluable in our work, particularly in the administration of nitrous oxide and oxygen. We consider nitrous oxide one of the most valuable and safe anesthetics, if administered by an experienced anesthetist, but dangerous in the hands of the untrained. Experience alone makes it possible for the anesthetist to provide such relaxation as will permit the surgeon to complete gall bladder, stomach or intestinal surgery in safety, and without interruption, with nitrous oxide. The advantages of modern methods in the hands of trained anesthetists have been pointed out many times in recent literature.

In a review of our own cases we note a great reduction in post-operative complications, especially after ventilation of the lungs by forced carbon dioxide inhalations and the post-operative application of the carbon dioxide and oxygen tent which we have devised for certain cases. The restoration of complete consciousness of the patient at the completion of operation affords better co-operation. The absence of nausea and vomiting is a very definite safety measure in the protection of the abdominal wound.

One of the most outstanding series of operations in which I have taken part as anesthetist, represents sixty cases of open reduction of fractures of the femur. A review of the literature in regard to such cases in the past twenty years shows a high mortality. I personally feel that the use of nitrous oxide anesthesia, with the aid of blood pressure observations every three minutes as an index of the patient's condition, has contributed in a great measure to the low mortality rate which we have observed in our series of cases. The blood pressure observations afford the anesthetist the opportunity to record the slightest change in the patient's condition far in advance of that which is afforded by pulse readings only.

When the records show a change in the rate and volume of the heart function, the patient is administered more oxygen, some carbon dioxide, and the surgeon is notified immediately so that he can adjust his technique of operation accordingly and hasten his patient to bed, thereby avoiding the development of deep shock. When the patient is placed in bed, measures for the control of shock are instituted and carbon dioxide and oxygen inhalations are administered intermittently for several hours by means of our inhalation tent. Close observations of these patients are made for the next forty-eight hours, including hourly blood pressure readings so as to avoid delayed or secondary shock. This technique has diminished the mortality and has proven of value in reducing the cost of compensation to the employer. I feel that this has been accomplished by careful study and the use of modern equipment in our hospital.

The Pennsylvania Nurse Anesthetists Association again wishes to thank the Pennsylvania Hospital Association for the encouragement and the fine spirit of co-operation. We shall continue in every possible way to advance our educational standards to meet the demands of our doctors and hospitals.

GREETING

CHARLES A. GILL

President, Hospital Association of Pennsylvania, Superintendent, Episcopal Hospital, Philadelphia

It is indeed a very unusual pleasure for me on behalf of the Hospital Association of Pennsylvania to extend to you greetings and a cordial welcome in meeting jointly with the Hospital Association.

I know of no one thing that has added more to hospital efficiency during the last twenty years than the introduction of the trained nurse in the art of administering anesthetics.

Many of us recall the time when internes spoke complainingly of spending the day pouring ether and that really is about what it amounted to.

The work of the anesthetist is one of the most vital services in the hospital and an extremely important aid to the surgeon.

I am convinced that your participation in this convention and that of the Hospital Association will prove profitable to all.

A friendly contact of this kind is always of great value.

PERTINENT FACTS

ABOUT THE

NATIONAL ASSOCIATION OF NURSE ANESTHETISTS

JUNE 17, 1931	ORGANIZATION MEETING UNIVERSITY HOSPITALS, CLEVELAND, O. THE FOUNDING AND PRESIDING OFFICER MISS AGATHA C. HODGINS FORTY NURSE ANESTHETISTS PRESENT, REPRESENTING TWELVE STATES
DECEMBER 2, 1931	INCORPORATED UNDER THE LAWS OF THE STATE OF OHIO
SEPTEMBER 13-15, 1933	FIRST ANNUAL MEETING MILWAUKEE, WISCONSIN
SEPTEMBER 25-27, 1934	SECOND ANNUAL MEETING, PHILADELPHIA, PENNSYLVANIA

MEMBERSHIP OF THE ORGANIZATION NOW TOTALS ONE THOUSAND NINETY-NINE, REPRESENTING FORTY-SEVEN STATES.

EIGHT STATE ORGANIZATIONS NOW WELL ESTABLISHED, AND SIX STATES IN PROCESS OF ORGANIZATION.

ANESTHESIA FROM THE SURGEON'S STANDPOINT

HAROLD L. FOSS, M.D., F.A.C.S.
Geisinger Memorial Hospital, Danville, Penna.

The first money I ever earned in the practice of medicine, (and I have been in practice now just twenty-five years this summer), was $10.00 for giving an anesthetic. Therefore, I am a candidate, I believe, for membership in your association. While my eligibility is being investigated may I tell you a little of the observations I have made during these twenty-five years, especially on the subject of anesthesia?

When I was an interne in the Philadelphia General Hospital ether was the chief anesthetic and was given by the open drop method and I might say, parenthetically, we still have no better anesthetic and no better method of giving it for the general run of surgical cases and for the average surgeon. We have seen chloroform gradually go out of use, particularly in this part of the country. When I was an interne in the old Blockley Hospital twenty-five years ago Jonnesco was in this country trying to popularize spinal and he tried it at Blockley but he had many serious accidents, deaths on the operating table and so it quickly fell into disfavor. In those early days I made several trips to Europe and always found the anesthetics administered by complicated apparatus, the first I had ever seen and in the most of them I found the old A. C. E. mixture which is still popular especially in continental Europe.

In those days there was a great deal of controversy over the status of the nurse anesthetist. It is a curious and inexplicable thing to me that, in some benighted states, the nurse anesthetist has no standing and is even legislated against, as in California, I believe. I think there is nothing in the world more stupid than this attitude. Anyone who claims that an intelligent woman, who has the background of a nurse's training in a modern American hospital, cannot learn to be as skilled an anesthetist as the average run of doctors, is viewing the subject with a myopic and astigmatic vision. I am not saying that the doctor anesthetist, who at present is being spoken of as the M.D. anesthetist, because of his training, might not be more skilled than the average nurse anesthetist, but if I were to have a serious major operation tomorrow I would rather have a good nurse anesthetist a thousand times rather than the average doctor with the average doctor's training. A friend of mine in a distant city where nurse anesthetists are not permitted to practice has permitted the County Medical Society to expel him from membership rather than give up his policy of using nurses to give anesthetics. In the greatest surgical center in this country, the Mayo Clinic in Rochester, Minnesota, all the anesthetics are given and have been given for many years by trained nurse anesthetists.

I was on the staff of the Mayo Clinic for several years and so I know to what extent the nurse anesthetist was relied upon in that famous institution. In my day ether administered by the open drop method was the favorite procedure of rendering insensibility to pain. Then came nitrous oxide

and oxygen largely as the result of writings of Dr. George Crile. Yet ether has been the stand-by for many years in the Mayo Clinic where probably more surgical operations are performed than any hospital in the world. However, at Rochester we gradually began to accumulate more and more apparatus of increasing complexity. Later Dr. Lundy was added to the staff and he, working with the Heidbrink Company, ultimately developed the well-known Lundy-Rochester model of the Heidbrink for the administration of nitrous oxide and ether and the newly discovered ethylene. The latter gas has been used very extensively there as we use it at the Geisinger Memorial in Danville and we like it extremely well.

I cannot understand the fear that some physicians have of ethylene. This fear has extended to the trustees in many institutions to the extent that they have absolutely forbidden its use, largely because of its explosibility. This is curious as in most of these institutions a combination of nitrous oxide, ether and oxygen is permitted, one which is as explosive as ethylene and one that has caused many accidents.

Much will yet be developed. Cyclopropane is one of the newer anesthetics but I feel it is too potent an anesthetic for general use and must be studied further. Vinesthene, and some of the barbiturate preparations introduced intravenously belong in the same class. Particularly with the latter I think one must be cautious and I see no reason to use it routinely when the other and much safer anesthetics are available. I think one of the greatest contributions in the whole field of anesthesia has been the one of gas rebreathing with simultaneous absorption of carbon dioxide. We have, at the Geisinger, recently discarded all our former apparatus and replaced it with machines of this type. There is a tremendous saving of gas, at least 75 per cent over the former method, and I am convinced that the anesthesia is smoother in every way.

Though nurses are not directly interested in spinal anesthesia, yet I am one of those persons who feel that, ultimately, the nurse anesthetist will be prepared and permitted to give spinal anesthesia. There is the bitterest feeling among certain doctors regarding spinal anesthesia. Doctors are an opinionated lot and are all individualistic to the last degree. If you wish to set brother against brother just start an argument on the relative merits of spinal and inhalation anesthesia.

As to the basal anesthetics given some time prior to the main anesthetic; scopolamine is still popular in many clinics but has given way, to a certain extent, to the barbiturates and the various derivatives therefrom. I think this has been a real contribution. No sedative yet given us has been quite so valuable as the pre-anesthetic sedatives amytal, nembutal, and similar drugs. Their administration, in small doses, render the use of such anesthetics as nitrous oxide satisfactory in fairly extensive operations. Pre-operative barbiturates followed by nitrous oxide and oxygen is the ideal anesthetic for surgical procedures on the thyroid gland. We have used it in over 3,000 operations on the thyroid at the Geisinger Memorial Hospital.

Rectal anesthesia produced with avertin, we have found to be of considerable value but have used it with caution because of the degenerative changes in the liver which have been recorded, especially from German clinics. However, when it is necessary to operate about the mouth, as in

resection of the tongue, or jaw, and in laryngectomies when one wants the anesthetist out of the way, it is the anesthetic par excellence. Its administration we turn over to our anesthetists and have perfect confidence in their ability to properly handle it.

Now what does the surgeon desire and expect in his anesthetist? First, and foremost he must have implicit confidence in her which comes from having performed many difficult operations in which she has not failed him, and has proved, conclusively, to the surgeon and his assistant from many observations of her work, to be worthy of becoming a member of the operating room force. I once heard a French surgeon speak of his operating team as a quartette or as he called it, a quartetto, likening the surgeon, his assistant, his anesthetist and the instrument nurse to the first and second violins and the cello and viola of the quartette. No doubt you have heard some of the famous ones like Flonzaley's. In seeing them play one witnesses the very personification of perfect team work such as must be the watchword of the operating room quartette. The anesthetist is just as important an individual in the operating room quartette as any of the other three and the life of the patient is just as much in the hands of the anesthetist and the success of the operation depends as much on her skill as on that of the surgeon.

Having confidence in his anesthetist, what more does the surgeon expect? He wants above all things adequate relaxation with safety. The various anesthetic measures are not only to relieve pain and to produce insensibility, but also to provide immobility and relaxation so that skillful and delicate surgical work can be carried out in the depths of the most inaccessible cavities and tissues. The anesthetist who permits struggling, rigidity, and nausea because the patient is only a half or two-thirds asleep and is kept so throughout the operation largely because the anesthetist fails, chiefly through timidity, to adequately administer the anesthetic and who does not break herself of this habit is sure to fail in inspiring confidence. Per contra, the anesthetist should not be so bold or so careless as to carry the patient far beyond the depth which is necessary for adequate relaxation.

Taking of blood pressure, reading pulse rates and other things which must be so carefully watched to determine just how much or how little anesthetic to administer, are of the first importance, yet I often feel that too much time is spent in making elaborate charts during the process of an operation. Though I believe in all of them, I yet believe they should be as simple as possible and only the essentials set down. At least the nurse's attention should not be so distracted that she cannot be in constant touch with every indication of the patient's condition. Not only must she be alert as to the patient's progress under the anesthetic but she must, by intuition, born of long experience, know just what stage of the operation is being performed and how near it is to completion, *i.e.* when the abdomen is to be closed and gage the depth of anesthesia accordingly.

And lastly, the anesthetist must be a psychologist. She must be able to appraise the patient's temperament and mental reactions. She should, by conversing with the patient, preferably in her room prior to the operation, or at least, in the anesthetizing room, be able to quickly evaluate

the whole psychological make-up of her patient and by a well-chosen word here or there promptly allay her fears and encourage her in the ordeal through which she is about to pass. And, finally, the nurse anesthetist is, in my opinion, going to acquire increased importance in the hospital personnel, and with greater recognition accorded her, her interest in organizations such as this will be encouraged. She should be given every opportunity to meet with her fellow anesthetists, to compare notes with them, to listen to papers, to visit hospitals and clinics and laboratories, in short to be afforded all the advantages for post-graduate advancement furnished the surgeon, who must come to realize that his anesthetist's broadness of vision is as essential as his own, and that, in many ways, the part she is playing in the role of modern surgery is almost as significant and important as the one assigned to him.

CLINICAL USE OF DIVINYL ETHER

EDITH D. PAYNE

Chief Anesthetist, University of Pennsylvania Hospital, Philadelphia, Penna.

At the University of Pennsylvania Hospital we have recently had the experience of being the first to administer divinyl ether as a general anesthetic to humans.

Divinyl ether, more commonly known as Vinesthene, was produced by Merck & Co., Rahway, N. J. It is a clear, colorless fluid with a not unpleasant ethereal odor. It is as explosive and inflammable as diethyl ether and is more volatile. The divinyl ether that has been prepared for anesthesia has added to it a small amount of absolute alcohol to prevent too rapid evaporation, and an inhibiting substance to prevent decomposition.

It is this mixture which was used in the extensive studies of Drs. Ravdin and Goldschmidt in the Research Laboratories at the University of Pennsylvania and which proved so successful that we have since been using it in our various clinics.

We have anesthetized, in all, 2190 patients with divinyl ether in two and one-half years. We have also in this series 1000 cases in which divinyl ether was used as induction to general anesthesia. The open drop method was used in about ninety per cent of the series, since it was believed that with so highly volatile an anesthetic this method offered the greatest safety until we had become more experienced with the use of the drug.

The technique of administration was as follows: After the eyes had been covered, a few loose layers of gauze were held a short distance from the patient's face. The anesthetic was dropped slowly about fifteen drops per minute, gradually increasing, and usually averaging from one to two c.c. per minute at the end of the operation. A dropper bottle was used such as is used for administering chloroform. If the open method was not employed, divinyl ether was administered in conjunction with nitrous oxide and oxygen, or with oxygen alone, the divinyl ether being placed in the ether reservoir. When given by this method a gas induction is generally used and divinyl ether can be added to the mixture sooner and in a much smaller quantity than diethyl ether, because it is not so irritating to the mucous membrane. It is most important that only a small amount of divinyl ether be used when given by the closed method, since rapid bubbling of the oxygen through it results in too great a concentration of the anesthetic in the inspired gas.

Blood pressure readings were recorded every five minutes in the first two hundred cases. The effect of the anesthetic on the blood pressure was similar to that of nitrous oxide, varying from twenty per cent increase to ten per cent fall during the first fifteen minutes, then maintaining the pre-anesthetic level with a variation of not more than ten per cent throughout the remainder of the operation. The pulse was exhilarated during the first few minutes, bounding rapidly but soon quieting down to the average pre-operative rate. This anesthetic was used without any

untoward effects, in patients with cardiac diseases, including advanced myocardial damage.

The respiration was quiet, as a rule, and of normal rate except when there was an excessive accumulation of mucus, which occurred in a small percentage of the cases, thus comparing favorably with the use of diethyl ether. When mucus was present, it disappeared immediately after recovery from the anesthetic. Even in the patients having excessive mucus there was no increase in the post-operative respiratory complications. The extraordinary absence of respiratory complications (two in over 2000 anesthetizations) may in part be explained by the care exercised in the selection of cases and the usual precautions taken in the first tests with a new anesthetic. Much as it is to be hoped for, it will not be surprising if this record is not maintained now that divinyl ether has come into general use.

Cyanosis was reported in eleven cases, which undoubtedly was due to the anesthetic being pushed in an effort to obtain surgical anesthesia. Only one case of cessation of respiration has been reported. This too, occurred as a result of pushing the anesthetic. A child fifteen months old was being anesthetized for an opthalmic examination when momentary respiratory arrest occurred, followed by cyanosis. After a short period of artificial respiration the color became good, and normal respiration was resumed.

The reflexes are not abolished as quickly as with diethyl ether, particularly the eye reflexes. Surgical anesthesia, however, is obtained when the eyeballs are oscillating rhythmically. The continuous movement of the eyeball at first disturbed us but subsequent experience proved that it was a state for which to strive, rather than one at which to be alarmed. We have noted that with divinyl ether it was relatively easy to maintain this stage throughout the operation and at the same time to have sufficient relaxation. The reflexes disappear only in deep, third-stage anesthesia.

In two per cent of the patients we observed excitement and this was of short duration. The rapidity of induction prevents, in even the most nervous patients, any real or prolonged stage of excitement. The length of time elapsing from beginning administration of the anesthetic, to surgical anesthesia varied, of course, with the type of operation. For relaxation sufficient for a laparotomy, from three to five minutes was necessary. For extra-abdominal lesions, the time required varied from a few seconds to three minutes, depending largely upon the type of individual.

Muscular relaxation was good. It was as complete in most instances as can be obtained with diethyl ether and was sufficient for the most extensive laparotomy.

The duration of anesthesia varied from a few minutes to two hours and fifty minutes. The open drop method was used for short cases and divinyl ether administered in conjunction with oxygen for operations requiring more than thirty minutes. Thus better muscular relaxation was obtained with a greater margin of safety.

Recovery was usually rapid. It was often possible to have the patient speaking at the time of the introduction of the last skin suture.

Recovery as a rule was smooth and only rarely accompanied by any excitement. When excitement did occur it was probably due to the rapid return to consciousness. In operations lasting twenty to forty minutes, the usual period of recovery, to the stage of being able to answer questions rationally, was from thirty seconds to five minutes. In an operation for carcinoma of the breast, lasting one hour and twenty-two minutes, the time from complete withdrawal of the anesthetic to recovery was twenty seconds. When preliminary sedatives were used, the period of recovery was sometimes longer. Only in a patient with pin-point pupils from the administration of morphine prior to anesthetization, did the recovery period exceed five minutes.

Vomiting during the recovery from the anesthetic, including simple eructation of mucus, occurred in 6.4 per cent of the cases and as a rule, consisted only of the emesis of mucus on one or two occasions. In one instance we believed that exaggerated vomiting was related to the anesthetic. A number of patients who had recently eaten were anesthetized in surgical emergencies, and the infrequency of vomiting was striking. In cases where post-operative oral feeding was not contraindicated the rapid return of appetite for food was also striking.

The urine was examined repeatedly before, and for several days after, operation in the first two hundred cases. In no instance did we obtain any evidence of renal irritation. If the urine was normal pre-operatively even after repeated anesthetization, no evidence of renal damage or irritation could be found.

The age of the patients varied from four months to eighty-six years. The anesthetic was so well tolerated by children that we have used it extensively for all types of operations. Forty of the patients were under two years of age and eighteen were over sixty. The physical make-up was of the variety encountered in any surgical clinic.

The operations for which divinyl ether has been used were varied, including almost every type of operation that has been performed in this hospital. About fifty per cent of the cases have been in the otolaryngology department. Two hundred and thirty were dental cases, and divinyl ether is unquestionably the most satisfactory anesthetic employed in this type of work. The degree of relaxation of the jaw obtained, the simplicity of its administration, and the even maintenance of the anesthesia makes it almost indispensable in oral surgery.

In the out-patient department this anesthetic has also proved valuable because the operations are short, the patients have no pre-anesthetic preparation and frequently have eaten heavily just prior to anesthetization. Even though many of these cases in our series were poor subjects for anesthesia, we feel that divinyl ether has been entirely satisfactory.

About 1000 of the cases were major operations, including operations for tic douloureux, brain tumor, middle ear disease, and operations on the soft parts and bony skeleton. Thyroidectomy, thoracoplasty, gastrostomy, gastro-enterostomy, appendectomy, herniorrhaphy, and mastectomy operations were also included. With the exception of two cholecystectomy operations performed, the anesthetic has not been used for operations on the biliary tract.

Divinyl ether has been administered to sixty-one patients three to five times; to two seven times; and to one nine times. The last was a child of twelve with an osteomyelitis of the tibia which required repeated operations at from five to seven-day intervals. The first time the child was very much frightened and excited but thereafter the anesthetic was taken in a calm, casual manner. Pre-operative hypodermics were not given and food was not withheld. The child did not experience nausea or vomiting, and each time had a keen appetite and retained food upon return to the ward.

Two of the interesting cases had taken the anesthetic seven times and thoracotomy operations had been performed. One was a boy of eleven, who had developed a lung abscess following pneumonia. The anesthesias were uneventful except for slight nausea following the second operation which lasted only a few minutes. The other patient was a girl of sixteen, who had had a bronchial fistula for a number of years which necessitated frequent operations. She had previously been given local and gas and was always excited and difficult to control. Divinyl ether proved of great value in this instance as the child had a dread of the gas mask being placed on her face. Divinyl ether was administered by the open drop method, the gauze never touching the child's face. This eliminated the fear and excitement to a large degree, and made it possible to send her back to her room in better condition. The two cases just cited were given the usual pre-operative preparation and light anesthesia was maintained throughout the operation.

In conclusion: Divinyl ether in our experience, from the standpoint of induction, maintenance and recovery, is a satisfactory anesthetic. It affords rapid surgical anesthesia with a minimum amount of the anesthetic, even maintenance of anesthesia, good relaxation, and rapid recovery. No untoward effects have been observed on blood pressure or respiration. The very low incidence of excitement, post-anesthetic vomiting and respiratory complications in our series, is noteworthy.

I am confident divinyl ether will find its place among the other general anesthetics now being used. In the last year it has been used quite extensively, not only in the United States, but in England, France, Germany, China, Canada and Labrador.

ANESTHESIA AND THE SURGEON

WILLIAM A. HAUSMAN, Jr., M.D., F.A.C.S., Sc.D.
Dean, Surgical Department, Sacred Heart Hospital, Allentown, Penna.

It is almost thirty-five years since I wrote my first medical paper; and this happened to be on anesthesia. I am quite sure the merits of the same were not such as to be remembered, or that my infant effort on that occasion created the demand as a consequence that I do penance for it, and write another on the same subject for this meeting. Especially could it not have been recalled by anyone in this group of nurses, none of whom were out of swaddling clothes so long ago as three and a half decades. My excuse at that time for this youthful indiscretion was, that I followed the advice of Doctor Will Mayo that young men should write papers; for as he said, even though they did no one else, who heard or read them, much good, yet they had this advantage, that nevertheless they helped those who wrote them; and in this way at least someone would be benefited.

While serving as an interne, the first and most frequent duty was to administer the anesthetic; under the direction and supervision of a surgeon. Note this particularly — under the surgeon's direction. Before being permitted to assist at any operation, an apprenticeship in anesthesia had to be served. So that anesthetist and surgeon were then as now, in close partnership. Always were they inter-dependent and in the relationship of senior and junior. Much water has gone under the bridge since those days, with many changes and additions in anesthesia; but this necessary principle of co-operation has remained the same. It must always be so, despite the fact that the purpose then was quite different from now, being at that time a part of general surgical training, rather than for the development of anesthesia per se.

General anesthesia as we now know it was discovered only about ninety years ago, and although this was the first step so essential to subsequent surgical development, another thirty-five years passed before it could be of much use; excepting in the absolutely necessary traumatic emergency surgery. For prior to this, infection was so common as to make almost all general surgery ineffective and therefore purposeless. Not until Lord Lister applied Pasteur's epochal discovery, were the shackles by sepsis broken and the restraints removed, permitting real surgical progress.

It took another twenty-five years before there was general acceptance even by the profession of the correctness in theory and in practice, of aseptic surgical technique. A new era had dawned with these two great discoveries — anesthesia and the germ-causation of disease coming in their proper sequence; but the full light of their benefits to humanity did not unfold until the end of the last and the beginning of our present century. Then came the great step forward, with wide spread application of these two all-important additions coming into their own. Throughout the early years one doctor would anesthetize for another, and few indeed and far between were those who could or did devote their time to anes-

thesia alone; just as in surgery, rarely was there a doctor who confined his work exclusively to surgical practice. The real specialist had not developed. Ether, chloroform and less frequently nitrous-oxide and ethyl chloride, were the general anesthetics most commonly used.

With a growing demand for special training, most doctors had to feel their way into a desired specialty, by learning from their own experience alone. There were comparatively few genuine specialists to supply the needs and demands for special tutorship. Therefore, there was some excuse at that time, but none now, for self-training only. Surgical aspirants were studying applied anatomy, when the etherizer was studying anesthesia while pouring ether for an operation. Likewise, there was more excuse then, little now, for the occasional surgeon and the occasional anesthetist. Today, the specialist should be such in fact as well as in name. He must have proper theoretical and practical training under a master surgeon or master anesthetist, of whom there are now a sufficient number to provide the needs in every community. A practice must be limited to one line of work, to justify the name of a real specialist. General practice is a recognized specialty and the general practitioner should restrict himself to it and not depart from his line of work, excepting in emergency, any more than any other specialist should do general practice. I can well remember how the earlier days differed, when I recall seeing a spittoon, placed on the tile floor of an operating room, along side the etherizer, that the general practitioner who was administering the ether might while away his time during a long operation, with a more substantial chew than Wrigley Gum.

The frequent changing of internes, the general practitioner as an anesthetist, and the prevailing custom of anesthesia being a stepping stone to surgery, was certainly not conducive to the best anesthesia; but I still believe it had this advantage, of making subsequently a more understanding surgeon, when such a one had faithfully served his apprenticeship in anesthesia. The correct criticism obtains however, that oftentimes the anesthetist as a surgical aspirant paid too much attention to the operation, thereby forgetting his responsibility while administering the anesthetic. This was always to the patient's detriment, either by serious consequences from too deep anesthesia or by the hampering of the surgeon's work in delay and interference with the surgical procedure, from insufficient and irregular anesthetization.

The increasing needs for better anesthesia by reason of greater demands for necessary improvement, made by the rapid strides in surgery, brought forward the nurse as a possible anesthetist. Her availability in our hospitals and a realization of the obvious shortcomings in haphazard anesthesia, made her a logical prospective anesthetist. In her development she at first lacked proper training by an incorrect approach to this important objective. She learned too often only from the anesthetic side and knew too little about the details of surgical procedure. This is gradually being overcome, but I fear too often still, does she lack sufficient knowledge of the necessary allied surgical training and surgical demands, to provide that well-balanced mixture of such great importance for the best interest of the patient. The surgeon also, to be a proper

director of his work in its entirety, must first be an experienced anesthetist, keeping abreast with anesthetic advance in every period. Not every nurse is adapted to be an anesthetist, any more than will every doctor be adapted to become a surgeon; and only when such adaptability is apparent should this special work be undertaken by the nurse.

So closely are anesthesia and the operative procedure entwined, that neither can be best done without a thorough understanding of the problems presenting to each, during the course of both. Only those surgeons who have enjoyed the luxury as well as appreciating the necessity of a thoroughly trained and widely experienced anesthetist, can realize what safety and comfort it is to the patient, and what it means to the surgeon to be relieved of the anxiety and disturbing factors, of being compelled to give more or less detailed attention to the administration of the anesthesia while operating. Nothing at an operation can be more satisfactory than that confidence which results from thorough co-operation between the anesthetist and the surgeon; nor can anything be more disturbing and disconcerting than the reverse. Conflicting temperaments of surgeon and anesthetist destroy the esprit de corps so essential to good work. A fussy, sulky, and worse still, a head-strong anesthetist, or the "know it all" nurse, is intolerable. I would point out that notwithstanding all the admitted provocation of a surgeon's shortcomings — excusable sometimes by the tension of his work — that the anesthetist must without fear or subserviency, maintain a proper poise and correct mental attitude, always remembering that the final responsibility must and does rest with the surgeon, as the director-general in the operating room. He it is in whom the patient places his or her confidence, and who in the final analysis is responsible and must answer for all who participate and contribute any part in the surgical setup. Prompt, intelligent obedience, is imperative. The best fitted and most wisely trained anesthetist recognizes this, and therefore requires the least direction.

The various combinations of drugs and machines used in the modern administration of anesthetics, are generally speaking proving to be advantageous. Nitrous-oxide and oxygen alone or with the addition of ether, and ethylene gas, are providing refinements and discriminations of unquestioned value for anesthetic betterment. But here again, I would call attention to the importance of laying a proper groundwork in the anesthetic training of the nurse; by her first having had special general operating room experience before all else; then thoroughly studying the history, chemistry, physiology and pathologic possibilities, of the original basic anesthetics, ether and chloroform, learning to administer them by the open drop method before using the various drugs, mixtures and apparatus, now playing so large and beneficial a part in modern anesthesia.

The trained nurse anesthetist, specially and properly educated, together with her general adaptability, has won her place as a most important, necessary and valuable asset to the surgeon. She has proven her worth in a teamwork that makes for the best surgery. That which is always for the best of the patient is, as it should be, the ultimate goal of all concerned. Finally, such meetings as these are an indication that we are striving towards such perfection. It can be and is being attained.

THE ACTION OF VARIOUS ANESTHETIC AGENTS WITH RESPECT TO THEIR CLINICAL ADAPTABILITY

E. J. KLOPP, M.D.

Professor of Surgery, Jefferson Medical College, Philadelphia, Penna.

Anesthesia has contributed no small part to the extraordinary progress made in surgery during the past two decades. With the direction of an increasing amount of research work, both clinical and scientific, to this important unit of the operative procedure we have advanced greatly with respect to the satisfaction, morbidity, and mortality of the patient; the facility with which the operation can be performed and the lessening of expense to the hospital.

We shall briefly consider, from the standpoint of their clinical applicability, the action of some of the various anesthetic agents available for use in the anesthetic department of the average modern general hospital. It is well to emphasize that the establishment of a routine use of one anesthetic or group of anesthetics for a particular operative procedure definitely courts fatalities, for such a routine disregards the all-important consideration of the type, age, psychic state, and general physical condition of the individual patient. Refinements in the technique of administration of the various gas anesthetic agents has not only increased their applicability but has also tended to lower morbidity and mortality figures and improved the end results obtained.

In the use of the carbon dioxide absorption technique, as described by Waters, a closed extension of the respiratory tract is obtained by means of a mask, canister of soda lime granules, and breathing bag. Expired carbon dioxide is retained in the soda lime in the form of a carbonate — oxygen consumption by the patient and that lost in passage through the anesthetic apparatus is replaced by a constant metered flow of oxygen. The introduction of the endotracheal catheter by Guedel and Waters marked a definite advance in the applicability of the gaseous anesthetic agents.

The administration of nitrous oxide and oxygen through the intratracheal catheter and with the carbon dioxide absorption unit secures greater muscular relaxation with a lessened consumption of the gas. Lahey has emphasized the fact that intratracheal anesthesia definitely tends to avoid the development of an operative emergency or complication in the removal of an intrathoracic goitre.

In the search for new inhalation anesthetic agents, several gaseous hydrocarbons have been studied. Ethylene administered with suitable apparatus in operating rooms properly equipped for its use has a definite field of usefulness. Its failure, however, to produce complete muscular relaxation in concentrations that do not produce oxygen want tends to limit its application. The explosiveness of the ethylene anesthetic mixture is well recognized and one sometimes wonders whether or not the prejudice and skepticism which exists against its more extensive use is not

rather unsupported by statistics. Dr. Herb, of Chicago, has reported over one million ethylene anesthesias with no explosions and no deaths. Bourne, of Montreal, states that it has been reported that twenty ethylene explosions have occurred in the operating rooms of this continent with one injury and five deaths and that during the same period there have been thirty-nine explosions with mixtures of nitrous oxide, ether and oxygen, with seven injuries and five deaths. The explosiveness of this latter mixture is often not sufficiently appreciated by student anesthetists. Intratracheal ethylene combined with regional infiltration of the abdominal wall with a local anesthetic agent will often produce quite sufficient relaxation for upper abdominal surgery.

Cyclopropane or trimethylene, the simplest cyclic hydrocarbon with its capability of producing narcosis when inhaled in a concentration as low as four percent, is becoming increasingly more popular as an anesthetic agent. Its ability to induce deep anesthesia without respiratory stimulation or irritation, the ample oxygen supply possible with its use (oxygen percentage of 90 in contradistinction to a percentage of 9 with the nitrous oxide mixture and percentage of 15 with ethylene mixture) and the quick recovery of the cough reflex following its use are all factors which tend to recommend it as an almost ideal anesthetic agent for cases requiring thoracic surgery, particularly those with an associated pulmonary tuberculosis. Although induction with cyclopropane is quite as pleasant as is that with nitrous oxide, recovery has been reported by some observers as being more frequently accompanied by nausea. It is reported from the Universities of Toronto and Wisconsin that the pharmacological effects of cyclopropane are such that anesthesia is produced without the metabolic disturbances which are caused by other anesthetic agents. This, Bourne states, is supported by the recent investigations made by Raginsky and himself. The present expensiveness of this gas no doubt contributes somewhat to its less extensive use.

Leake, Knoefel, and Guedel, of the University of California have contributed a new ether, divinyl ether or vinyl oxide, to the list of inhalation anesthetic agents. At the University of Pennsylvania, Goldschmidt, Ravdin, Lucke, Muller, Johnston, and Ruigh have studied the clinical and pharmacological actions of divinyl ether in a large number of cases (461 patients, 411 of whom were anesthetized by nurse anesthetists) and have found that it affords rapid surgical anesthesia with a minimum amount of the anesthetic, even maintenance, good relaxation and rapid recovery with no untoward effects being observed on the blood pressure or respiration. Bourne and Raginsky have studied its effects upon the liver and found it to be quite innocuous. It is as explosive and inflammable as diethyl ether but is more volatile. Since its administration by the "open drop" method incurs a needless waste, it is best used in a closed system with oxygen. While divinyl ether seems peculiarly suitable to obstetrics, its true status in the field of anesthesia awaits further clinical experience.

Numerous derivatives of barbituric acid have been studied with respect to their anesthetic possibilities. Some of these have been found wanting in clinical application and have been discarded, while others, such as evipan, pernocton, and sodium amytal suggest the possibility of

a limited but satisfactory clinical application. The indiscriminate use of this group of drugs is to be avoided, for when idiosyncrasies exist, there follows delayed action, extreme depression, excitement, and even mania, for untoward actions of the barbiturates are referable to the brain, the other organs being only slightly affected as pointed out by Bourne, Bruger, and Dreyer in 1930, in their splendid study of the effects of amytal on the liver, kidneys and blood. By and large, this group of drugs is best utilized for the relief of dread and anxiety in operative cases rather than in the production of surgical anesthesia. Evipan, however, which was first isolated in Germany and which, as pointed out by Beck, created a sensation in that country to such a degree that one whole session of the German Surgical Congress was devoted to its discussion, promises to be useful for operative procedures of short duration. Given intravenously it produces rapid anesthesia which lasts from twenty to thirty minutes. In experimental liver damage the drug is slowly broken down and since it abolishes the swallowing reflex tends to be contraindicated in some operations about the mouth and pharynx. The technique of its administration has not been definitely developed as yet and the method of determining dosage requires additional accurate study before its true application as an anesthetic agent is obtained. Nembutal has been recommended as the most satisfactory of the barbiturates for the production of analgesia in the early stages of labour by Irving, Berman, and Nelson, at the Boston Lying-In Hospital. This touches upon but a very limited number of the drugs in this group but in passing we are reminded of Dr. Wesley Bourne's statement that if many more derivatives of barbituric acid are brought forward, we should be inclined to quote the Bulgarian proverb: "All those twopenny saints will be the ruin of the Church."

The introduction of avertin or tribromethanol has definitely widened the field of anesthesia by making possible a method of general anesthesia described by Watter as hypnesthesia (an interpretation of avertin basal narcosis) in which the integral parts of the narcosis are a hypnotic and an anesthetic agent used in a very definite succession with both of these substances of equal importance. A point emphasized by Watter and often not amply appreciated by the anesthetist is that in hypnesthesia the classical stages of anesthesia are absent. This, he has explained, is due to a difference in mechanism; instead of analgesia first and relaxation after, as we have in anesthesia, we have in hypnesthesia relaxation first followed by analgesia. This is achieved by a two-way attack on the psychic centers, the somatic centers remaining remarkably free from any degree of impairment and securing, thereby, in many instances freedom from many of the undesirable post-operative symptoms which usually follow the use of an inhalation anesthetic agent alone. Avertin is absorbed into the blood stream, broken up in the liver and excreted through the kidneys. Many able investigators have carefully studied the effect of avertin upon the vital organs and tissues of the body and while there is and probably always will be those who dissent against its use, the observations made by Bourne and O'Shaughnessy in their study of one thousand avertin anesthesias concurs well with the results obtained by several other investigators. They found that clinical and laboratory in-

vestigations on the action of avertin upon the nervous system, the respiratory system, the cardiovascular system, the blood and upon the functions of the liver and kidneys showed that in comparison with other anesthetics avertin may be considered practically safe provided it is administered in suitable dosage. Several of our earlier cases came to the operating table cyanotic and upon investigation we found that the cyanosis was not an indication of respiratory or circulatory depression in cases under avertin basal narcosis but due rather to obstructed ventilation because of early masseter relaxation and improper support of the jaw. Unobstructed ventilation may be insured by the early introduction of a mechanical airway in those cases in which support of the jaw is difficult. In this connection it is well to recall that Rosenthal and Bourne in 1924 showed that cyanosis due to improper oxygenation is followed by liver damage.

Our conclusions from a careful survey of the special anesthetic and post-anesthetic records kept upon the first five hundred cases in which we employed avertin to produce basal narcosis are here presented:

(1) The use of tribromethanol offers a safe and satisfactory form of basal narcosis when administered in carefully determined dosage to fit subjects by properly trained anesthetists.

(2) The correct dosage of tribromethanol cannot be arrived at on the basis of the patient's body weight alone but only by an intelligent evaluation of the patient's personality, habits and general condition and due consideration of the type of operation to be performed.

(3) Correct technique involves the proper preparation of the anesthetic enema, the exercise of care in its administration and the careful observation of the patient especially with regard to the maintenance of an unobstructed airway.

(4) The calm period of induction, the utilization of but fractional doses of supplementary inhalation anesthetic, a post-operative period characterized by much less of the usual psychic and gastro-intestinal disturbance, the degree of amnesia produced, and conservation of body heat are all points in favor of the use of tribromethanol in production of basal narcosis.

(5) The uncontrollability of the action of the anesthetic agent once it is administered and its capability of producing a powerful local irritant action if improperly prepared must be appreciated by those employing tribromethanol.

(6) The moderate depression of the cardiovascular and respiratory systems which follows the use of tribromethanol anesthesia in proper dosage responds promptly in the great majority of instances to the stimulation produced by the administration of the supplementary inhalation anesthetic agent and the operative procedure.

(7) The administration of tribromethanol in overdosage or to an unfit subject definitely courts a fatality.

(8) Precautions must be taken in the application of hot water bags post-operatively, for in some few cases cutaneous sensation is impaired for a variable length of time.

(9) The true status of tribromethanol in the field of anesthesia will only be established by the direction of further study of its action upon the vital organs of the body especially with respect to its eliminatory process and the impartial reporting of the results obtained from its use in a large number of operative procedures of varying types.

Spinal anesthesia in experienced hands, skillfully administered to properly selected cases has a real place in general surgery. Due regard must be given, however, not only to the general condition of the patient but also to the type of operative procedure contemplated and the length of time needed for its proper completion. High and long spinal anesthesia is many times associated with dangerous degrees of shock and must be scrupulously avoided if we would keep our morbidity and mortality figures low. This type of anesthesia is applicable, in many instances, to surgery of the lower extremities, pelvis and lower abdomen. Its value in cases of intestinal obstruction is well recognized. In upper abdominal surgery spinal anesthesia has a definite place in the good risk case in which the operation will not require over an hour's time.

This, in a brief way, covers some of the more generally accepted anesthetic agents. The search for the ideal anesthetic continues and with the vast amount of worthy research work, both from a clinical and scientific standpoint, that is being devoted to this important branch of surgery, it may well develop that we are now only on the threshold of achievement in modern anesthesia.

The role of the well-trained nurse anesthetist is a most necessary one in the field of anesthesia. She must be properly trained, however, not only in the art of administration of inhalation anesthesia but also in the basic physiologic principles underlying adequate respiration and circulation. The responsibility for this training rests with the hospital and the individual surgeons and if they would secure the advantages of modern developments in anesthesia, it behooves them to encourage certain enthusiastic physicians to interest themselves in and become expert with the various methods of anesthesia and thereby insure also adequate training and skillful supervision of the nurse anesthetist.

THE NEW YORK ASSOCIATION OF NURSE ANESTHETISTS

The second annual meeting of the New York State Association of Nurse Anesthetists was held in conjunction with the New York Hospital Association, May 23rd and 24th, 1935, at the Hotel New Yorker, New York City.

The attendance was about one hundred, and the program was excellent. A short business meeting was held, at which the following officers were elected for a term of two years:

CORA McKAY, *President*

President—Miss Cora McKay, Albany Hospital, Albany, N. Y.

Secretary-Treasurer—Miss Hazel Blanchard, 1910 7th Ave., Troy, N. Y.

Historian — Miss Helen Craven, Bellevue Hospital, New York, N. Y.

An application by the New York State Association of Nurse Anesthetists for membership in the state division of the National Association was read and resolution covering same passed unanimously.

NEW YORK ASSOCIATION OF NURSE ANESTHETISTS

FINANCIAL REPORT

May 1, 1934 to May 1, 1935

RECEIPTS:		
Cash on hand May 1, 1934	$293.12	
Initiation fees	46.00	
Dues	760.66	
		$1099.78
DISBURSEMENTS:		
1934 State Convention Expenses, New York City	$212.71	
National Convention expenses—Milwaukee	84.26	
1935 Convention badges	6.00	
Printing and stationery	103.50	
Office expenses	26.04	
Postage	29.41	
Transfers to National Association	385.25	
		847.17
Cash on Hand May 1, 1935		$ 252.61

(Signed) IDA M. EDWARDS,
Secretary-Treasurer.

Miss Cora McKay, President of the New York State Association of Nurse Anesthetists, received the following letter, dated June 4, 1935, from Carl P. Wright, Executive Secretary of the Hospital Association of New York State:

My dear Miss McKay:

"It is my duty and privilege to advise you that the Hospital Association of New York State, assembled in its Eleventh Annual Convention in New York City last month, unanimously adopted a resolution expressing its sincere and appreciative thanks to the New York State Nurse Anesthetists Association for having joined with us in consideration of our common problems.

"May I add my personal appreciation of your very splendid cooperation.

"Very truly yours,

(Signed) C. P. WRIGHT,
Executive Secretary."

MR. P. GODFREY SAVAGE

President New York State Hospital Association; Director Niagara Falls Memorial Hospital

It is only through organization that any group can protect its interests these days. This is particularly true of the Nurse Anesthetists. Despite the fact that many physicians prefer the nurse anesthetist for individual service, there are a great number who would be glad to set up restrictions that would abolish the privilege of a nurse becoming a trained anesthetist. From considerable discussion on this subject, it is quite evident that the discriminating surgeon insists upon a medical anesthetist or a nurse anesthetist, but always a trained anesthetist.

The hospital administrator cannot very well insist upon a particular basis except that he will do everything in his power to obtain the best service possible for his particular institution. The results obtained usually depend upon such factors as geography and other local conditions, availability of funds and the prevailing viewpoints in the medical group serving the individual community.

A year ago at the convention of the Hospital Association, Dr. Elting, Chief Surgeon of the Albany Hospital, gave a splendid address in behalf of the nurse anesthetist. He said, "I am thoroughly convinced after twenty-five years, at least, of continuous trial, that the welfare of the patient is very much better off in the hands of a trained, skilled nurse anesthetist than in the hands of any other arrangement or organization which has as yet been suggested."

It is quite certain that the Hospital Association of New York State will not support any program to abolish the trained nurse anesthetist in this field of important service. We favor a department of anesthesia in every hospital that can establish it with a trained medical anesthetist as director and assisted by trained nurse anesthetists to complete an effective organization. It also goes without saying that we would always prefer to see trained nurse anesthetists in the service in preference to untrained physicians serving as such.

The Association of Nurse Anesthetists has done well in protecting the interests of this branch of hospital service and is certain to prosper in the further development of high standards of professional procedure. As President of the Hospital Association of New York State, I wish you every success.

SPINAL ANALGESIA

CHARLOTTE F. KUHN, R. N.
Crown Heights Hospital, Brooklyn, N. Y.

I feel deeply honored to have been chosen on this occasion to address a group of nurse anæsthetists, and it is an added pleasure to speak to you today on the subject of spinal analgesia. To begin with, I would like to mention that I am greatly indebted for my experience in this field to my instructor, Dr. Harry Koster, whom you all know as an advocate of spinal analgesia and whose definite and unvarying technique and procedure in surgery is uncanny. Through his efforts, I have successfully administered over a thousand spinal anæsthesias and have observed the reactions of approximately 7,500 patients over a period of seven years. This anæsthesia is used routinely for all major operations in our clinic.

The first event in the history of spinal analgesia dates back to 1859 with the discovery of cocaine by Nieman. It was used as a local analgesia, later to be subcutaneously administered. The discovery of intraspinal analgesia was accidental. J. Leonard Corning of New York City in about 1885 produced spinal analgesia by giving a supposed therapeutic extraspinal injection of cocaine. He produced the effect desired below the diaphragm and later published a report of his success. Slightly later, August Bier of Bonn, Germany, after experimenting with spinal analgesia on his own body, was using it successfully on his patients. It was left to Jonnesco, Le Filliatre and others in about 1908 to produce analgesia above the diaphragm by the injection of stovain and tropocaine. During the past generation, Crile, Babcock, and Labot have advocated and done much work in this field toward the development of the technique. It is now, we believe, one of the safest methods of producing analgesia.

Spinal analgesia at the present time is used in patients ranging from early childhood to advanced age. The amount of drug employed varies from 30 mgm. to 300 mgm. according to the age of the patient and the duration of analgesia desired. Dr. Floyd Rhomberger of Lafayette, Indiana, in a visit to our institution has stated that in the middle west they use as high as 1500 mgm. with impunity. We have never had occasion to use more than 300 mgm., and with that amount of drug our surgeon has been able to perform multiple operations on patients because this anæsthesia intercepts all impulses originating at the operative field and bound for the cerebrum, thereby producing practically no shock to the patient. Operations such as hysterectomy with vaginal plastic and perhaps hemorrhoidectomy or higher abdominal surgery, including cholecystectomy, appendectomy and vaginal repair have been performed within an hour, which is the average time allotted for 150 mgm. of neocaine to wear off.

There is a minimum amount of preliminary preparation necessary on the part of the patient. The field of operation and the lumbar portion of the back is shaved. No intestinal purging is necessary except in surgery on the colon or rectum. Diet, which is an important factor in general an-

æsthesia, is not essential in spinal analgesia. The percentage of post-operative complications is no greater in patients that have been brought into the hospital with an acute condition and operated the same day than those that were admitted the day previous and subjected to preliminary care.

When the patient is placed on the operating table, he or she is told that the only pain felt will be the prick of a needle. From experience, as I have been the subject of a spinal analgesia myself, I can frankly state that was the only sensation I felt and it is comparable to the injection of an ordinary hypodermic needle. There is absolutely no pain attached to the needle penetrating the deeper tissues and dura. Most patients are co-operative.

We occasionally encounter patients who object to this form of anesthesia. Some individuals of a highly neurotic nature desire to be made entirely oblivious to their surroundings, others because they anticipate pain in the introduction of the needle and a smaller group refuse operation because they prefer not to hear what is going on and would rather be asleep. Formerly gas oxygen was used to render these patients co-operative until the spinal was administered. Recently we have been using sodium amytal 0.5 gm. to 1.0 gm. (dosage according to age) intravenously and we have found that as a preliminary to spinal anæsthesia it is advantageous in eliminating the psychic factor in apprehensive patients. A small percentage of these patients proved to be very restless during the procedure of the operation. This restlessness is manifested by attempting to move the upper extremity and muttering incoherently, which is continued for some time after the patient is returned to bed. Ofttimes it was necessary to apply a restraint. For this reason we have found nembutal to be a far more effective drug to replace amytal, and as compared to the latter, there is only a slight degree of restlessness present. There is no noticeable change in pulse rate, the patient may take on a slightly dusky appearance due to relaxation of the jaw, causing obstruction in the free exchange of air during respiration. The trained anæsthetist observes and readily overcomes this difficulty.

I will now endeavor to describe our technique and steps in the administration of a spinal injection. A sterile tray is set up for this purpose. It comprises the solution for sterilization of the skin, two sponge holders, two ampules of neocaine, a file, a Labot syringe with two needles and a towel. The patient is placed in the lateral prone position for the spinal puncture. It is more comfortable for the patient, and individuals that are uncooperative can easily be controlled. The sitting position is used only in severe scoliosis or extreme obesity where the median line of the back cannot be determined in the lateral position. Patients having had nembutal are also better controlled in the sitting position. After the patient is in the lateral prone position on the table, an assistant secures flexion of the trunk by approximating the head and the knees. Since cooperation of the patient is not always procurable it is wise to be prepared to maintain the trunk flexion while the spinal puncture is being done. By applying a well-known wrestling principle," a cradle," it is easy to maintain this position. With the patient on the left side, the assistant

stands on the side of the table facing the patient and approximates the head and knees of the patient after having extended the patient's arms overhead. He then places his right arm around the neck and his left around the knees, both from behind forward so that the hands can be clasped in front of the patient; the latter is now rendered helpless. The important feature beside clasping the hands is to be certain that the patient's arms are extended overhead. This will prevent any rotation of the spine. The exposed portion of the back between the sacro-coccygeal junction and the lower dorsal spine is painted with picric acid (6 per cent in 60 per cent alcohol) and a sterile towel is placed over the side of the patient above the sterilized field so that the crest of the ilium can be located by the operator with the fingers of the left hand. An imaginary line between the superior part of both iliac crests crosses the spinal column between the third and fourth lumbar vertebræ. The thumb of the same hand (after the fingers determine the space between the third and fourth vertebræ) is passed to the space above. At this point the puncture is made. The base of the spinous process of the second lumbar vertebræ is comparatively thicker than the others and this is regularly felt in locating the interspace between the second and third, namely the injection site. The axis of the interspace between the lumbar spinous processes varies. The space between the fifth and fourth lumbar is almost horizontal, whereas that between the vertebræ above is slightly upward and forward. The distance between the bodies and spinous processes of the second and third lumbar vertebræ is great enough to allow a needle introduced perpendicular to the place of the back in the median line between the bases of the two spinous processes to enter the subarachnoid space without impinging on any bony parts. Attached to the base of each spinous process is the supraspinous ligament. Between each spinous process (running from one to another) are the interspinous ligaments and along the posterior wall of the spinal canal extends the ligamentum subflavum. Each of these can be felt by the penetrating needle, and the last is a dependable guide to the depth of the needle-point. Several trials enable one to identify the ligament easily by its characteristic resistance to the passage of the needle. The spinal dura is continuous with that which invests the brain. It is a loose sheath, unattached to the bony framework of the spinal canal and is separated from it by loose areolar tissue containing a plexus of veins. The latter are more numerous in front and on the sides. Very few are found posteriorly. The arachnoid is separated from the dura by a slight interval, the subdural space. Between it and the pia is the subarachnoid space containing cerebrospinal fluid. The cord terminates opposite the lower border of the first lumbar vertebræ (opposite the third lumbar vertebræ in the child).

The needle is introduced perpendicular to the plane of the back in the median line through the skin, subcutaneous tissue, supraspinous and interspinous ligaments, the ligamentum subflavum, the dura, arachnoid and finally into the subarachnoid space. It may be necessary occasionally to tilt the needle slightly upward at an angle of 10 degrees. This necessity arises only when incomplete body flexion is secured. After the needle is introduced perpendicularly in the median line of the body to a depth of about 5 cm., cerebrospinal fiuid will be obtained. After the

needle has entered the subarachnoid space, the stylet is withdrawn and cerebrospinal fluid is allowed to flow into and fill the ampule containing the neocaine crystals. About 3½ to 4 cc. of fluid is required to fill the ampule. Rapid solution of the crystals takes place after drawing the solution in and out of the syringe a few times. The needle on the syringe is then discarded and the solution containing the dissolved drug is then reinjected into the spinal canal, after removing the stylet. It is injected with the same rate and force as that of a hypodermic injection. After injection the needle (with syringe attached so that no fluid is lost) is rapidly withdrawn. The patient is then placed in slight Trendelenburg position of about an angle of 8 to 10 degrees. If the operation is not to extend over one hour and the site of operation is below the diaphragm, 150 mgm. of neocaine dissolved in 4 cc. cerebrospinal fluid will be found to be adequate. When, however, the operation involves the structures above the diaphragm, 300 mgm. of neocaine, (using two 150 mgm. ampules) dissolved in 8 cc. of cerebrospinal fluid will be required. Since the ampule containing 150 mgm. holds 4 cc., it is necessary to fill the two ampules. The greater the diffusion of drug, the higher the level of anaesthesia which will be obtained. Incomplete analgesia is attributed to the use of needles with long bevelled edges which penetrate the dura only partially, in that way getting a spill of cerebrospinal fluid outside the canal. Should the anæsthesia be incomplete, the patient receives another administration of neocaine. If the needle is introduced into the spinal canal far enough to encroach upon the anterior wall with its marked vascularity, a blood tinged fluid will be obtained. The needle is not in the spinal canal if you obtain a pure bloody fluid, and should be withdrawn part way and introduced at the proper angle. If the needle is introduced through the skin at an angle, the distance from the median plane becomes greater as the penetration increases. Even though the introduction through the skin may be in the median line, the needle may be one or more centimeters lateral to the spinal canal at a depth of 5 cm. This will explain the dry tap or bloody tap by the distorted course of the needle. If these instructions are followed, only one tap will be necessary and any discomfort to the patient will be avoided in the introduction of the needle.

Analgesia of the lower extremities is obtained almost simultaneously. After two to five minutes, the time it takes to drape the patient for operation, the anæsthesia has reached the level of the ensiform cartilage. Should there be any doubt in the mind of the operator as to the completeness of the anæsthesia, the patient should be questioned concerning the sensations in the lower extremities. If he replies that he is unable to raise his leg and that there is a feeling of numbness or tingling in the latter, that is sufficient confirmation that the incision can be made. The pressure sensation at the field of operation produced by the surgeon disappears between 5 and 10 minutes after anæsthetic is given. For operations that require the patient to be in the lateral recumbent position, the patient after receiving the anæsthetic is placed in the dorsal position for a few minutes to insure an even diffusion of the anæsthetic agent. The patient is then placed in the lateral position. For the first five minutes after anæsthesia 99 per cent of the patients are comfortable. During the

next ten minutes there is a diminution in pulse rate, regardless of the rate before anæsthesia. In about 75 per cent of the cases the pulse rate ranges between 56 and 72 beats per minute. In about 25 per cent it ranges from 24 to 36 beats per minute. The diminution in rate is not always gradual, it is sometimes very sudden. The rhythm is always regular. This is also true in patients with cardiac conditions. The respirations are normal, but become diminished in amplitude. With this sudden slowing down of pulse rate and diminution in the amplitude of respiration at the same time associated with a drop in blood pressure, there is a resulting anemia of the brain which in turn brings on a slight cyanosis or greyish pallor of the face and causes the patient to become nauseated and in some instances bring on vomiting movements. With the onset of the vomiting movements the pulse rate increases, respirations are deeper and the patient is more comfortable. However, if the patient does not vomit at this stage with the markedly low pulse rate, it may result in a form of muscular twitching of the face and upper extremities, with the cessation of pulse rate and apparent loss of consciousness. This spasm lasts for a fraction of a second, the pulse returns and the twitchings stop. Oxygen or oxygen with 5-10 per cent carbon dioxide if administered before the pulse rate drops below 40 per minute will offset this spasm. Often a few breaths of oxygen will be found to be adequate, as it slightly raises the blood pressure and increases the pulse rate. Oxygen is essential in overcoming this condition. No other stimulation is administered and no untoward complications arise.

The patient has absolutely no control over vomiting movements. Vomiting occurs in about 25 per cent of the cases. It is more often due to palpation of the abdominal viscera, such as exploration of the gastro-intestinal tract, or emptying of the gall bladder manually for inspection. Moving patients from the operating table to stretcher and again from the stretcher to bed invariably causes vomiting. The slowing down of pulse rate and subsequent anemia of the brain is another cause. Vomiting movements during the operative procedure are of short duration and do not interfere with the work of the surgeon. I have noted that with increased dosage of anæsthesia there is less tendency to vomit. For this reason we have increased the dosage for operations below the diaphragm from 100 mgm. to 150 mgm. I have observed that vomiting with high anæsthesia, namely 300 mgm. is rare. Oxygen relieves nausea and overcomes the desire to vomit.

The patient may complain of inability to breathe, while at the same time the respiratory excursion is normal.

Another frequent complaint is pain in the region of the heart. This is of short duration, lasting for two or three minutes, then disappearing. The anæsthetist can reassure the patient in that respect.

Blood pressure readings are no indication to the condition of a patient. In the first 2500 cases operated under spinal analgesia, careful blood pressure records were kept and a graph made. It was found that it was impossible to predict in any case after the spinal injection, just what would happen to the blood pressure. In some instances there would be no appreciable change. Other patients would show a fall of 8 or 10 mm. of mercury, others again 20 to 30 mm. of mercury. Some blood

pressures would remain low for three-quarters of an hour, others would return to normal after 10 minutes. In at least 5 per cent the pressure would drop within 10 minutes to such a level that no pressure could be registered by the manometer for perhaps 10 minutes, and no radial pulse felt. I always reported this coincidence to the surgeon who invariably would order stimulation for the patient. After a while we found out that the blood pressure always returned providing the patient was kept in the Trendelenburg position, regardless of stimulation. We have long since discontinued keeping a record of blood pressure readings and of giving stimulation to increase the blood pressure.

Why is it necessary to have the patient in the Trendelenburg position? In carrying out this procedure we must have a knowledge of the effect of the drug on the nerve tissues and blood vessels. The nerve control of the blood vessels is made up of two sets of nerve fibres, the constrictors and dilators. The vasomotor nerves leave the spinal cord by the anterior roots of the spinal nerve and connect with the splanchnic nerve, which is the most important nerve that supplies the abdominal viscera. The splanchnic receives the branches of nerves coming from the roots of the nerves of the spinal column. When the anæsthetic is introduced into the subarachnoid space, the impulses of the branches of nerves are intercepted. The vasomotor stimuli coming from the medullary of the brain are also intercepted. This failure of the impulses from the brain to produce stimuli results in a dilatation of the splanchnic vessels in the abdomen to such an extent that they can hold almost all the blood in the body. Therefore the supply of blood which is essential for a normal brain can be maintained by gravity, namely the Trendelenburg position. This drains the blood to the heart, which in turn carries it to the brain. One can readily understand the uselessness of subcutaneous stimulation.

In approximately 20 per cent of the cases there is obliteration of the radial pulse. A facial or temporal pulse is always obtainable although it may be of very soft volume. As blood pressure rises the volume becomes stronger.

The skin is dry. Immediately after the introduction of the anæsthetic there is sometimes increased activity of the sweat glands which lasts for a few minutes and the skin then becomes dry and remains so throughout the procedure of the operation. With incomplete anæsthesia there is marked perspiration, clammy skin and rapid pulse. In prolonged surgery the face may become moist and cool, the body may be dry, the lips may have a slight cyanotic tinge due to diminished respiratory excursion. Oxygen administered will pink up the patient and shortly afterward the skin will have a warm, dry feeling.

The eye signs parallel that of general anæsthesia. With the usual dosage of 150 mgm. of anæsthetic we observe a slight oscillation of the eyes after the diffusion of drug takes place above the diaphragm. The pupils are normal, but slightly contracted with the use of morphine sulphate as a premedication. With high anæsthesia, using 300 mgm. of neocaine the pupils are mid-dilated or dilated, and dry. The patient with high anæsthesia is usually very drowsy or sleeping. The amplitude of

respiration is diminished. One must be able to distinguish between normal sleep under spinal analgesia and approaching anemia of the brain. When the patient is drowsy or sleeping the respirations are deep enough to maintain the normal color of the individual, the eyes will be closed but through the lids will be noted active oscillation. With approaching anemia of the brain the patient may assume the normal appearance of sleep, the respirations are very shallow, the skin has an ashen or dusky appearance, the eyes suddenly turn downward, the patient's respirations become stertorous and the patient will become spastic immediately after. The anæsthetist should be observing enough to notice any slight changes in the appearance of the patient and to administer oxygen before the respirations become too shallow. The pink color of the patient's skin and mucous membrane of the lips is always maintained. In general anæsthesia exsanguinated patients require a greater amount of oxygen; the same rule applies with spinal anæsthesia.

Patients are returned to the ward in the Trendelenburg position. The beds are placed in slight Trendelenburg before the patient is transferred. The beds remain in slight Trendelenburg for two hours until all the anæsthesia has worn off. If the patient is anemic or under deep narcosis, oxygen with 5 per cent carbon dioxide by the open method is administered until the anæsthesia has worn off.

Spinal anæsthesia is less toxic than the so-called general anæsthetics. The depressing action, which is slight, occurs in the early stage of the anæsthetic when the patient can best stand it. It affords the greatest amount of muscular relaxation unequalled except in death. The intestines are quiet, they do not come into the abdominal wound with each respiration. Under spinal anæsthesia peristaltic action is increased. This relaxation of abdominal viscera simplifies the work in abdominal surgery and enables the operator to do multiple operations without fear of shock to the patient. Due to its non-toxic and rapidly eliminating qualities, it is especially beneficial in cachectic, aged and poor risk cases. Patients near a moribund state tolerate this anæsthetic whereas any other form could not be considered. It has its advantages with confirmed alcoholics; as anæsthetists we have all had experience inducing general anæsthesia in this type of patient. In cardiacs it slows the pulse rate, in that way resting the heart during the operative procedure.

Individuals with hypertension are temporarily benefited by the drop in blood pressure.

For toxic thyroid cases it is ideal; in conjunction with intravenous nembutal the patient need not know that she is to be operated. The psychic element is controlled without seeking the patient's cooperation. The eyes need no special protective covering as the patient is asleep. The air passages are free from mucus.

For gall bladder operations the dorsal position is used, and ample relaxation is secured, whereas with general anæsthetics special gall bladder positions are required, lap pads to keep the intestines back and respiratory movements, all hamper the progress of the surgeon and prolong the time of anæsthesia for the patient.

For fractures it gives the maximum amount of relaxation, enabling the surgeon to get better approximation of the fragments.

In patients with tuberculosis or empyema we consider it the anæsthesia of choice. The cough reflex is eliminated, while the respiratory movements are active. There is no splashing of pus around the field of operation with each respiratory movement.

It is less toxic for diabetics and for surgery of the genito-urinary tract.

COMPLICATIONS

Headache is the most frequent complication of spinal anæsthesia. I have experienced this phenomena and would like to convey to you my reactions to this bugbear. It is usually manifested the first half hour after the introduction of anæsthesia by dizziness which is increased in severity on raising the head and shoulders. The milder forms disappear within a few days. The persistent type will last for a short period of time up to a few weeks. The pains occur mostly in the parietal region, anterior or posterior and last for a fraction of a second (they are never continuous) in circumscribed areas of the head. The pain comes on gradually, increases in severity and gradually disappears, all within a flash of a second. After a few days the intervals between these attacks become longer and the pain milder in character. Activity of the daily routine will exaggerate the pain. A foreign body, such as dried particles of blood in the needle, impurities in the anæsthetic agent, or tissue from the surrounding area carried in the canal with the introduction of the needle may be a direct cause of headache. Seepage of fluid outside the spinal canal caused by failure of the puncture hole to close may be a contributory factor. If a fibrin clot forms, the puncture hole closes, otherwise it heals normally. Because of the seepage of spinal fluid outside the canal there is a resulting disturbance of the intracranial pressure of the cerebrospinal fluid. With this disturbance, in conjunction with marked anemia and accompanying weakness, it is sufficient in my estimation to give rise to headache. With anemia causing a lack of oxygen to the brain for a period of time before operation, we cannot expect normal function to resume immediately after. The complicating headache is of little consequence except for the temporary discomfort to which the patient is subjected. It is apparent that diagnostic lumbar puncture frequently terminates in this complication, proving that the anæsthetic itself has no bearing on the headache.

MEDICATION

In mild cases that last two or three days, the medication consists of pyramidon or aspirin, this often affording relief. The horizontal position is maintained. In severe cases of headache 6 oz. of 50 per cent mag. sulphate retentive enema and repeated after 4 hours is very often beneficial. If this does not give relief, 2 cc. of 50 per cent mag. sulphate intravenously has given satisfactory results, or 100 cc. of 5 per cent sodium chloride solution given intravenously has proved beneficial. If the headache is due to increased pressure with ocular disturbances, a spinal tap is indicated. Ocular disturbances are transient and always clear up before the patient goes home.

Backaches are experienced by a very small percentage of cases, usually the result of repeated attempts to enter the subarachnoid space.

In my experience of over 7,000 spinal anæsthesias we have had one case of paresthesia and one of paralysis. A woman who had extensive vaginal repair work developed paresthesia of the lower extremity. She recovered and was able to walk within a month. The latter was a man who was operated upon for a kidney abscess. He developed paralysis and subsequently expired. From all appearances this looked like a case of paralysis due to spinal anæsthesia, however, upon autopsy it was revealed that the patient had carcinoma of the kidney with metastasis to the dorsal spine, compressing the cord.

In the hundreds of thousands of spinal inductions over a period of 20 years, there have been only nine cases of spinal meningitis reported in the literature. This is a very rare complication and with the proper technique is avoided.

During my stay at Kings County Hospital as anæsthetist, I observed that spinal anæsthesia was resorted to by the surgeons for aged, cachectic individuals that one would hardly consider as a good risk for operation, supposedly selective cases, as leg amputations, etc. While they treated this anæsthetic very cautiously, still there were no fatalities as the result of spinal anæsthesia during the two and one-half years I spent there. Why, if spinal anæsthesia is considered safe for these individuals, is it not accepted as the anæsthesia of choice for those patients who come to operation in a better and less toxic condition?

In our institution, spinal anæsthesia has been applied to almost every type of operative procedure. It is safe, non-toxic and fulfills all the requirements of the ideal anæsthetic agent. The ease and rapidity with which it is administered, the non-irritating effect on the tissues, the freedom from pain, the complete relaxation produced, the apparently bloodless field of operation due to lowered blood pressure, the very little nursing care these patients require post-operatively, all tend to make it one of the most widely used and safest anæsthetics of the future.

Our research department is doing extensive work to determine the effects of this drug on the tissues and the causes of the complications.

OBSTETRICAL ANALGESIA AND ANESTHESIA

MARTHA HENNEBERGER
Woman's Hospital, New York City, N. Y.

Founded in 1855 through the efforts of J. Marion Sims, M.D., and incorporated in 1857, the Woman's Hospital has the distinction of being the first institution in the world established by women "for the treatment of diseases peculiar to women, and the maintenance of a lying-in hospital."

The present capacity of the hospital is 318 beds — 226 surgical and 92 obstetrical. The obstetrical department has 35 private beds and 57 ward beds; included are six toxemia observation beds, six labor room beds, and three isolation beds. Ward patients are admitted to the labor rooms and are under the observation and treatment of the obstetrical staff of the hospital. A well-trained and cooperative nursing staff is in constant attendance. Three large, modern delivery rooms connect with the labor rooms.

Each delivery room is equipped with a complete anesthesia set-up. The anesthesia department consists of five nurse anesthetists under the supervision of Dr. Raymond C. Coburn. It is the duty of the attending obstetrician or the delivery room supervisor to report to the anesthetist any abnormal condition of the patient. When the patient is ready for delivery the anesthetist is called. The order is given by the attending obstetrician as to what he wishes the patient to have — analgesia with pains or anesthesia for delivery.

A ward service routine has been established by Dr. Coburn, which is as follows:

All patients having chest conditions, colds or sinus infection are given gas-oxygen. All patients with high blood pressure, cardiac conditions and complicated toxemias are given open drop ether. All complicated deliveries, such as breech extraction, version, Scanzoni rotation and high forceps cases are given gas-oxygen and ether.

Anesthesia charts are kept by the anesthetist. The patient's condition is recorded every fifteen minutes. All drugs administered during the delivery are checked. The blood pressure is taken at the end of the delivery, by the anesthetist. This record must be complete before the anesthetist leaves the delivery room.

During the year 1934, 1409 anesthetics were administered to obstetrical patients: G.O. 595; G.O.E. 626; Ether 78; Chl. Ether 44; Spinal 6. Cæsarean section: G.O.E. 60 cases.

In favor of anesthesia as it has been used in the second stage of labor since the introduction of chloroform and ether, and more recently gas-oxygen, it may be said that anesthesia relieves the woman in labor of part or all of the severe pain of the second stage; that the relief of pain tends to prevent nervous fatigue and its attendant shock; and the operative measures when indicated can be carried out more easily and skilfully.

Within recent years a number of new analgesic preparations have been introduced to the medical profession. Some of these after careful

experimental and clinical studies have been found to be of great value; others after an initial wave of enthusiasm have fallen into disrepute, either because they failed to produce the desired effect or the margin of safety was too restricted to warrant their use.

In 1934 a clinical study of avertin was made by Dr. George Gordon Bemis at the Woman's Hospital. It is the purpose of this next paragraph to report the summary of the clinical observations made in a series of 75 obstetrical cases that had been given avertin during the latter stages of labor for the relief of pain.

The unfavorable reaction noted in this series, was the depression of the circulatory and respiratory systems. The apparent predisposing factors of these depressing effects were shock, profound toxemia and hypertension. The usefulness of avertin in obstetrics during labor is limited greatly by its frequent failure to satisfactorily relieve the patient of pain and at the same time allow labor to progress. Its use is further restricted by the relatively short duration of satisfactory action. Obstetrical patients under the influence of avertin frequently become extremely restless, uncooperative and difficult to manage. Post-partum atony of the uterus with abnormal blood loss is not an unusual complication. Avertin apparently had no unfavorable effects upon the baby. It is essential that the patient who has had avertin have the exclusive services of a nurse until entirely out of anesthesia.

Dr. Irving and his co-workers have recently published the results of the use of eight different combinations of hypnotics in the production of anesthesia during labor. The drugs used were:

Pantopon Scopolamine	Pentobarbital sodium Scopolamine
Pantopon Rectal ether	Pentobarbital sodium Rectal ether
Pernocton	
Sodium amytal Scopolamine	Pentobarbital sodium Paraldehyde
Sodium amytal Rectal ether	

Ether oil and avertin, which must be given rectally, and pernocton and the barbituric acid derivatives when used intravenously, have the common fault that patients may be susceptible to them. This cannot be guarded against owing to the rapid and uncontrollable effect of rectal absorption and of intravenous medication and the narrow margin of safety when the actual anesthesia is produced.

Each combination was administered in a dosage aimed to produce complete amnesia. After studying eight series of 100 patients each, Dr. Irving and his co-workers stated that they believed the combination of pentobarbital sodium and scopolamine was the most effective. Eighty per cent of the patients receiving these drugs had complete amnesia. Eighty-three per cent exhibited no excitement, and sixty-three per cent of the infants breathed immediately on birth. In this group, however, the incidence of operative deliveries was 47 per cent in primiparas and 37 per cent in multiparas.

If an analgesic is to be used it is suggested that one of the safest forms of analgesia known at present is that obtained by the oral administration of pentobarbital sodium. This drug should be given by mouth, not intravenously (except in eclampsia) and should be given in repeated doses, selecting the total dosage to the needs of the patient. The first dose of 1½ to 3 grains of pentobarbital sodium may be given when the cervix is dilated about 3 centimeters, depending on the frequency of the patient's discomfort. A dose of 1½ grains of the drug is repeated every 30 to 60 minutes, although treatment is individualized in each case. The average dose of pentobarbital sodium in a given case is from 6 to 7½ grains or more. The combination of pentobarbital and scopolamine proved more effectual than the former alone. All external stimuli should be avoided. The complete cooperation of a well trained assisting staff is important. The drugs should be administered only to carefully selected patients. Sufficient medication is necessary and careful observation of the patient is essential.

The limits of the investigation have confirmed the original premise, *i.e.*, safety to mother and child. There was no maternal mortality. There was no fetal mortality that could be attributed to the drug. Labor was not inhibited for any appreciable time and delivery anesthesia was reduced. The third stage of labor was without untoward incidence and postpartum recovery was uneventful. Blood loss was within normal limits and the blood pressure was not appreciably affected. Excitement occurred infrequently and was controllable.

At the present time a clinical study of pentobarbital sodium is being made at the Woman's Hospital. The anesthetists have reported all pentobarbital sodium cases as requiring less anesthetic than the others, and more than half of these, about 25 per cent of the total number, needing little or no ether at the end of the second stage. Recovery immediately postpartum was found to be uneventful. There has been no case of marked respiratory infection.

In this country the demand for relief of pain by the parturient woman is so insistent that the successful practitioner of obstetrics must use in most labors some means for its relief. The ideal analgesia or anesthesia should be safe for both mother and child and should not interfere with the efficiency of uterine contractions or the patient's cooperation so as to decrease to any appreciable extent the number of spontaneous deliveries. As yet no method of relief of pain in labor has been discovered which entirely fulfills this requirement.

In 1915 the Anesthesia Department of the Woman's Hospital consisted of two anesthetists — Dr. Frederic Montgomery and his assistant, Dr. Edward Sweeny. Dr. Clement Cleveland, Chief Surgeon at the hospital, conceived the idea that nurses should be trained in the art of anesthesia. The 59th annual report of the Anesthesia department for the year ending December 31, 1915, read as follows:

> "The employment of trained nurses as anesthetists which was put into effect in the early spring, has proven, as it was hoped it would, a most advantageous change in the economy of time. One of the special advantages of note is the presence of

the anesthetists in the hospital at all times, ready at call night and day. These nurses were selected for their intelligence and trustworthiness and have been found quick to learn and we can now pronounce them experts in the art."

NEW MORTALITY RECORD FOR THE WOMAN'S HOSPITAL

The hospital has announced that all maternal mortality records at Woman's Hospital since the inception of its obstetrical service twenty-five years ago were broken in 1934, the year passing without the death of any mother among 814 who attended the prenatal clinic. Based on figures included in the 79th annual report of the hospital, made public recently, it was announced that a record number of twins were born and that a new low for deaths among maternity ward patients was established, only one mother having died in the ward during 1934. Of the 1,385 births at the hospital there were twenty pairs of twins.

In announcing the 1934 figures, Dr. George Gray Ward, Chief Surgeon at the hospital, said that this record should go a long way toward removing the impression of the public that the percentage of mortalities in private hospitals was greater than in cases where only home treatment was received. The all-time record established at the hospital, which cared for the 16,102 women during the year, was seen by Dr. Ward as resulting from the prenatal clinic work and the follow-up care by the hospital staff.

THE NURSE ANESTHETIST

EDNA KNIGHT
Rex Hospital, Raleigh, N. C.

When the respiration softens and slows
And the surgeon is deft and sure,
There are rose colored glasses upon your nose,
The world is full of allure,
There's no other profession quite so great,
You wouldn't change with a queen,
You are sure you are favored by—well—fate—
And things really must be—what they seem.

When maybe the very next patient will be
Everything that the other was not,
And all the rose hued visions flee—
And the whole future's gone to pot!
The respiration is fast and short,
The "field" is rigid and dense,
The surgeon straightens—pauses—and—snorts!
You silently pray—and grow tense—

You're right, no profession is quite so great,
And no one so small as you—
Just then—mighty effort—things somehow come straight
And, miraculously, you do too!
And at night—Oh, at night in the depth of repose
When the 'phone rings infernally shrill!
You've heard it? Well, then you're another who knows
Long suffering, endurance, iron will.

The way from your rooms to the hospital seems
So long, dark shadowed and dim,
The song, "When I grow too old to dream"
Changes at two a.m.
To, "When I grow too old to run,"
For the flying heels give warning
That alone in the dark it isn't fun
At two o'clock in the morning.

L'Envoi

When the last soft sleep o'ertakes you
From which 'phones can ne'er awake,
May there be no long dark shadows,
Surgeon's snorts, or any ache
To mar the long, well-earned repose,
But may the angels keep
A special guard of honor
O'er the Nurses Who Give Sleep.

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Leadership,
behind

OHIO GASES

Over fifty years ago, this Company began producing Nitrous Oxid.

Throughout the intervening half-century, constant research has been responsible for the success and reputation earned by "Ohio" products.

With the introduction of nitrous oxid and oxygen in 1883; of ethylene in 1923, and of cyclopropane in 1933, Ohio experts have maintained their reputation as—

"PIONEERS AND SPECIALISTS IN ANESTHETICS"

THE OHIO CHEMICAL & MANUFACTURING CO.

1177 Marquette St. **Cleveland, Ohio**